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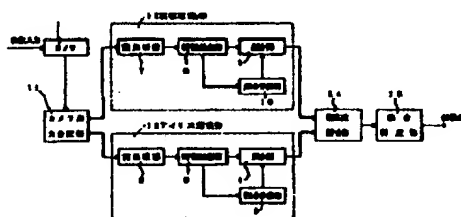
(54) INDIVIDUAL IDENTIFICATION SYSTEM

(57) Abstract:

PROBLEM TO BE SOLVED: To make it possible to perform sure identification without forcing an unnatural posture to a person to be identified, severely limiting illumination conditions, and without using a camera having many pixels.

SOLUTION: The iris pattern and face pattern are respectively obtained from the image, which has been photographed by a camera 1, of a person to be identified in an iris recognizing part 12 and a face recognizing part 13 and collated with an iris pattern and a face pattern registered in advance and respective degrees of similarity are found. These degrees of similarity of iris pattern and face pattern are coupled by a similarity degree coupling part 14, and based on the coupled result, a total judgement part 15 judges whether or not the iris pattern and face pattern provided from the image of the person to be identified show the same figure as the iris pattern and face pattern used for collation.

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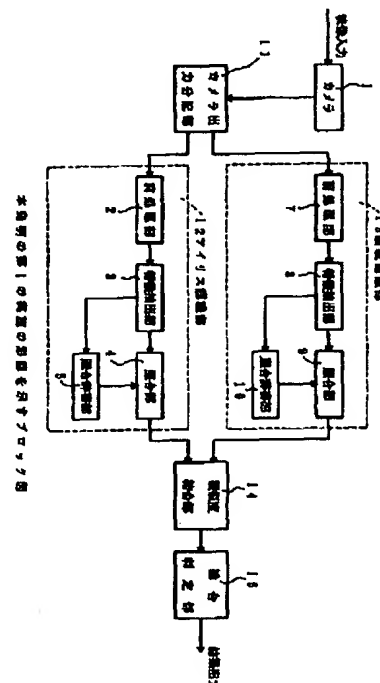
(74) 代理人 弁理士 金倉 喬二

(54) 【発明の名称】 個人識別装置

(57) 【要約】

【課題】 被識別者に無理な姿勢を強いたり、照明条件に厳しい制限を加えず、かつ画素数の多いカメラを使用することなく、確実な識別を可能とする。

【解決手段】 カメラ1で撮影した被識別者の画像からアイリス認識部12及び顔貌認識部13でそれぞれアイリスパターン及び顔貌パターンを得ると共に、予め登録されているアイリスパターン及び顔貌パターンと照合してそれぞれの類似度を求め、このアイリスパターンの類似度と顔貌パターンの類似度を類似度結合部14で結合して、その結合結果に基づいて総合判定部15により被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定する。



【特許請求の範囲】

【請求項1】 被識別者を撮影し、その画像から特徴抽出して得たアイリスパターン及び顔貌パターンを、予め登録されているアイリスパターン及び顔貌パターンと照合してそれぞれの類似度を求め、

このアイリスパターンの類似度と顔貌パターンの類似度を結合して、その結合結果に基づいて被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定することを特徴とする個人識別装置。

【請求項2】 請求項1記載の個人識別装置において、人物を撮影するカメラと、

このカメラが撮影した画像からアイリスを切り出す前処理部、この前処理部によって切り出されたアイリスの特徴を抽出してアイリスパターンを得る特徴抽出部、登録時にこの特徴抽出部により得られたアイリスパターンを登録する照合辞書部、及び識別時に特徴抽出部により得られたアイリスパターンを前記照合辞書部に登録されているアイリスパターンと照合して類似度を求める照合部を有するアイリス認識部と、

前記カメラが撮影した画像から顔の輪郭及び特徴を示す領域とその相対関係等を検出する前処理部、この前処理部に検出された顔貌の特徴を抽出して顔貌パターンを得る特徴抽出部、登録時にこの特徴抽出部により得られた顔貌パターンを登録する照合辞書部、及び識別時に特徴抽出部により得られた顔貌パターンを前記照合辞書部に登録されている顔貌と照合して類似度を求める照合部を有する顔貌認識部と、

前記アイリス認識部及び顔貌認識部のそれぞれの照合部から送られてくるアイリスパターンの類似度と顔貌パターンの類似度を結合する類似度結合部と、この類似度結合部から送られてくる結合結果に基づいて被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定する総合判定部を備えたことを特徴とする個人識別装置。

【請求項3】 被識別者を撮影し、その画像から特徴抽出して得たアイリスパターン及び顔貌パターンを、予め登録されているアイリスパターン及び顔貌パターンと照合してそれぞれ類似度を求め、

アイリスパターンの類似度により被識別者の画像から得たアイリスパターンが照合に用いたアイリスパターン同一人物のものか否かを判定し、

同一人物のものでない場合、アイリスパターンの類似度と顔貌パターンの類似度を結合して、その結合結果に基づいて被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定することを特徴とする個人識別装置。

【請求項4】 請求項3記載の個人識別装置において、

人物を撮影するカメラと、

このカメラが撮影した画像からアイリスを切り出す前処理部、この前処理部によって切り出されたアイリスの特徴を抽出してアイリスパターンを得る特徴抽出部、登録時にこの特徴抽出部により得られたアイリスパターンを登録する照合辞書部、及び識別時に特徴抽出部により得られたアイリスパターンを前記照合辞書部に登録されているアイリスパターンと照合して類似度を求める照合部を有するアイリス認識部と、

10 前記カメラが撮影した画像から顔の輪郭及び特徴を示す領域とその相対関係等を検出する前処理部、この前処理部に検出された顔貌の特徴を抽出して顔貌パターンを得る特徴抽出部、登録時にこの特徴抽出部により得られた顔貌パターンを登録する照合辞書部、及び識別時に特徴抽出部により得られた顔貌パターンを前記照合辞書部に登録されている顔貌パターンと照合して類似度を求める照合部を有する顔貌認識部と、

前記アイリス認識部及び顔貌認識部のそれぞれの照合部から総合判定部を介して送られてくるアイリスパターンの類似度と顔貌パターンの類似度を結合する類似度結合部と、

20 前記アイリス認識部の照合部から送られてくるアイリスパターンの類似度により被識別者の画像から得たアイリスパターンが照合に用いたアイリスパターン同一人物のものか否かを判定し、

同一人物のものでない場合、前記アイリスパターンの類似度と前記顔貌認識部の照合部から送られてくる顔貌パターンの類似度を前記類似度結合部により結合させ、その結合結果に基づいて被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定する総合判定部を備えたことを特徴とする個人識別装置。

【請求項5】 請求項1及び3記載の個人識別装置において、

アイリスパターンの類似度と顔貌パターンの類似度を、

$$T = k * R_i + (1 - k) * R_f$$

T：総合類似度

R_i：アイリスによる類似度

40 R_f：顔貌による類似度

k：定数（1 > k）

という式により、結合することを特徴とする個人識別装置。

【請求項6】 被識別者を撮影し、その画像から特徴抽出して得たアイリスパターン及び顔貌パターンを結合して特徴パターンを作り、

この特徴パターンを予め登録されている特徴パターンと照合して類似度を求め、

その類似度に基づいて被識別者の画像から得た特徴パターンが照合に用いた特徴パターンと同一人物のものか否

かを判定することを特徴とする個人識別装置。

【請求項7】 請求項6記載の個人識別装置において、人物を撮影するカメラと、このカメラが撮影した画像からアイリスを切り出す前処理部、及びこの前処理部によって切り出されたアイリスの特徴を抽出してアイリスパターンを得る特徴抽出部を有するアイリス認識部と、

前記カメラが撮影した画像から顔の輪郭及び特徴を示す領域とその相対関係等を検出する前処理部、及びこの前処理部に検出された顔貌の特徴を抽出して顔貌パターンを得る特徴抽出部を有する顔貌認識部と、

前記アイリス認識部及び顔貌認識部のそれぞれの特徴抽出部から送られてくるアイリスパターンと顔貌パターンを結合して特徴パターンを作る特徴結合部と、

登録時のこの特徴結合部で作られた特徴パターンを登録する照合辞書部と、

識別時に前記特徴結合部から送られてくる特徴パターンを前記照合辞書部に登録されている特徴パターンと結合してと照合して類似度を求める照合部と、

この照合部から送られてくる類似度に基づいて被識別者の画像から得た特徴パターンが照合に用いた特徴パターンと同一人物のものか否かを判定する総合判定部を備えたことを特徴とする個人識別装置。

【請求項8】 請求項6記載の個人識別装置において、アイリスパターンと顔貌パターンのベクトルで結合することを特徴とする個人識別装置。

【請求項9】 請求項2、請求項4、及び請求項7記載の個人識別装置において、

人物を撮影するカメラを1台とし、このカメラの出力を、アイリス認識部と顔貌認識部の両方に分配するカメラ出力分配部を備えたことを特徴とする個人識別装置。

【請求項10】 請求項2、請求項4、及び請求項7記載の個人識別装置において、

アイリス用カメラと顔貌用カメラを備え

アイリス用カメラで撮影した画像をアイリス認識部に送り、

顔貌用カメラで撮影した画像を顔貌認識部に送ることを特徴とする個人識別装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、人間の生態的特徴、特に眼球のアイリスを利用して個人を識別する個人識別装置に関するものである。

【0002】

【従来の技術】 金融機関で自動取引装置により取引操作を行う場合、あるいはコンピュータ等により秘守性のあるデータにアクセスする場合、更には特定の人間のみが入れる施設等への入場の際等に、その資格の有無をチェックするための個人識別が行われる。

【0003】 この個人識別の技術として、現在種々のも

のが考えられ、あるいは実施されているが、その1つとして人間の眼球の一部であるアイリスを利用して個人を識別する技術がある。このアイリスは幼児期に完成され、一生を通じて殆ど変化せず、また太る、痩せるという体格の変化の影響も受けにくいという特徴があるので、識別精度が高く、そのため将来的に多方面での応用が期待されている。

【0004】 図12はアイリスを利用した従来の一般的な個人識別装置を示す機能ブロック図である。図において1は映像入力を行うカメラ（ビデオカメラ）、2はこのカメラ1で撮影された画像からアイリスを切り出す処理すなわち前処理を行う前処理部、3はこの前処理部2によって切り出されたアイリスの特徴を抽出してそのパターンをコード化する特徴抽出部で、4はこの特徴抽出部3から送られてくるアイリスパターンを照合辞書部5に登録してあるアイリスパターンとを照合して両者の間の類似度を求める照合部であり、ここで照合辞書部5には予め複数の人數分のアイリスパターンが貯えられている。

【0005】 6は照合部4によって算出された類似度から両アイリスパターンが同一人物のものか否かを判定する判定部である。この構成において、前処理部2、特徴抽出部3、照合部4、及び判定部6は、マイクロプロセッサや専用演算ハードウェアによって構成されるのが一般的であり、また照合辞書部5は、半導体メモリや磁気ディスク等で構成されるのが一般的である。

【0006】 次に、上述した構成の作用について説明する。図13はアイリスパターンの登録モード時の処理手順を示すフローチャートであり、図14はアイリスパターンの識別モードの処理手順を示すフローチャートである。まず、図13の登録モードについてSで示したステップに従って説明する。

【0007】 登録すべき者の上半身の映像がカメラ1により撮影される。つまり映像入力される（S1）。次に、撮影された画像が前処理部2に送られて、この前処理部2で被識別者の画像から頭部の切り出し（頭部の位置の割り出し）が行われ（S2）、更に、この頭部の画像から目の切り出し（目の位置の割り出し）（S3）、そしてこの目の画像からアイリスを切り出す（アイリスの位置の割り出し）処理が順次前処理部2で行われる（S4）。

【0008】 この切り出されたアイリスの画像が特徴抽出部3に送られ、特徴抽出部3で照合に必要な特徴が抽出される（S5）。具体的には、アイリスを必要な分析帯に分割したり、ガボールフィルタ等によりアイリスの濃度変化を抽出する等の特徴抽出が行われる。そして、抽出されたアイリスの特徴は特徴抽出部3で正規化され（S6）、2値データとしてコード化されて（S7）、最終的に256バイト程度 of アイリスコードがアイリスパターンとして生成される。

【0009】このようにして生成されたアイリスパターンは、登録者名、ID番号、及び日付等の必要なデータが付加され、照合辞書部5に登録される(S8)。次に、図14の識別モードについて同じくSで示したステップに従って説明する。尚、このモードにおいて前記のように照合辞書部5に複数の人のアイリスパターンが登録されているものとする。

【0010】まず、被識別者の映像入力(S1)、頭部の切り出し(S2)、目の切り出し(S3)、及びアイリスの切り出し(S4)の各処理が前記登録時の場合と同様に前処理部2で順に行われた後、アイリスの特徴抽出(S5)、正規化(S6)、及びコード化(S7)の各処理が前記登録時の場合と同様に特徴抽出部3で行われてアイリスパターンが生成される。

【0011】生成されたアイリスパターンは照合部4に送られ、照合部4ではこの特徴抽出部3から送られてきたアイリスパターンと照合辞書部5に登録されているアイリスパターンを照合(マッチング)演算し、類似度を求める(S8)。この場合の照合演算では、ハミング距離などの距離値が類似度の尺度としてよく用いられる。

【0012】この照合部4での照合により選択されたアイリスパターンの類似度(距離値)は判定部6に転送され、判定部6では送られてきた類似度を、実験や統計的手法によって予め求めた1つあるいは複数のしきい値と比較し、被識別者の画像から得られたアイリスパターンが、照合辞書部5の中の照合したアイリスパターンと同一人物のものかどうかの判定を行う(S9)。

【0013】尚、この識別モードにおける照合処理では、照合用として照合辞書5に登録されているどの(誰の)コードを用いるか、あるいはいくつの(何人の)パターンを用いるかは、自由に選択できるようになっており、システムの仕様によって決定されるが、大別して次の2種類の形態が採用されている。その1つは、被識別者の画像から得られたアイリスパターンに対して、照合辞書部5に登録されているアイリスパターンのうちの照合すべきパターンが判っている場合つまり1対1の照合であり、別の1つは、照合辞書部5に登録されているアイリスパターンのうちの照合すべきパターンが判らず、登録されている複数人のアイリスパターンの中から、最も確からしいアイリスパターンを選択する場合つまり1対nの照合である。

【0014】1対1の照合の場合には、照合部4は、1つのアイリスパターンを用い類似度を算出し、その算出結果を判定部6に対して出力する。この場合の判定では、類似度を1つあるいは複数のしきい値と比較し、被識別者の画像から得られたアイリスパターンが、照合したアイリスパターンとが同一人物のものであるか否かの識別を行う。

【0015】1対nの照合の場合には、照合部4は照合辞書部5の中の複数のアイリスパターンを照合して照合

演算を行い、その第1位あるいは上位m位(mは任意の値)の類似度を判定部6に送出する。この場合、判定部6は、第1位あるいは上位m位の類似度を1つあるいは複数のしきい値によって判定し、被識別者の画像から得られたアイリスパターンが、照合したどのアイリスパターンに最も類似しているか、あるいは十分に類似していないか等を調べて、被識別者の画像から得られたアイリスパターンと照合したアイリスパターンとが同一人物のものであるか否かの識別を行う。

10 【0016】

【発明が解決しようとする課題】しかしながら、上述したアイリス利用の個人識別装置では認識装置では、被識別者が撮影時にまばたきをしたり、髪の毛が目にかかる等のことによる映像の不安定さ、あるいは周囲の照明条件による映像取得の不安定さ等により、正確なアイリスのデータが得られない場合、確実な識別が困難になり、識別率が下がるという問題があった。

20 【0017】このような問題を解決する上で、映像の安定化を得るために、被識別者に無理な姿勢を強いたり、周囲の照明条件に厳しい制限を加えたりすることは、ヒューマンインタフェース上好ましくなく、更に単純に認識率を上げるために、画素数の多いカメラを使うと、処理量の増加、装置の大型化、高価格化、消費電力の増加などが避けられなくなり、現実的でないものとなる。

30 【0018】従って、本願発明の課題は、被識別者に無理な姿勢を強いたり、周囲の照明条件に厳しい制限を加えたりすることなく、かつ画素数の多いカメラを使用することなく、確実な識別が可能で、高い識別率が得られる個人識別装置を実現することである。

40 【0019】

【課題を解決するための手段】そのため、本発明は、被識別者を撮影し、その画像から特徴抽出して得たアイリスパターン及び顔貌パターンを、予め登録されているアイリスパターン及び顔貌パターンと照合してそれぞれの類似度を求め、このアイリスパターンの類似度と顔貌パターンの類似度を結合して、その結合結果に基づいて被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定することを特徴とする。

50 【0020】

【発明の実施の形態】以下に図面を参照して本発明の実施の形態を説明する。図1は本発明による個人識別装置の第1の実施の形態の構成を示すブロック図である。この識別装置は、人物の撮影を行うカメラ1、カメラ出力分配部11、アイリス認識部12、顔貌認識部13、類似度結合部14、及び総合判定部15により構成されている。

【0021】ここで、カメラ出力分配部11はカメラ1からの出力を受け、その出力をアイリス認識部12と顔貌認識部13にそれぞれ送出する。アイリス認識部12

は、前処理部2、特徴抽出部3、照合部4、及び照合辞書部5から成り、また顔貌認識部13も、前処理部7、特徴抽出部8、照合部9、及び照合辞書部10によって構成されている。

【0022】アイリス認識部12における2~4の各部は図13に示した構成要素と同一のもので、顔貌認識部13の7~10の各部は2~4のものに相当する。一方、類似度結合部14は、アイリス認識部12の照合部4及び顔貌認識部13の照合部10からそれぞれの類似度を受け、総合類似度を算出して総合判定部6に送出するもので、総合判定部15は、類似度結合部14から送られてくる総合類似度から被識別者がアイリス認識部12の照合辞書部5及び顔貌認識部13の照合辞書部10に登録されている人物かどうかを判定してその判定結果を出力する。

【0023】次に、このような構成による装置の作用について説明する。この装置は、登録モードと識別モードの2つのモードで動作するもので、図2は登録モードのフローチャートであり、図3は識別モードのフローチャートである。まず、図2の登録モードについて、Sで示したステップに従って説明する。

【0024】登録すべき者（登録者）の上半身の映像がカメラ1により撮影される。つまり映像入力される（S1）。このカメラ1の出力はカメラ出力分配部1に送られ、このカメラ出力分配部1によりカメラ1で撮影された画像がアイリス認識部12及び顔貌認識部13のそれぞれの前処理部2及び7に分配される（S2）。

【0025】アイリス認識部12では、頭部の切り出し（S3）、目の切り出し（S4）、アイリスの切り出し（S5）、アイリスの特徴抽出（S6）、正規化（S7）、及びコード化（S8）の各処理が従来と同様に前処理部2及び特徴抽出部3により行われてアイリスパターンが照合辞書部5に登録される（S9）。一方、顔貌認識部13では、前処理部7がカメラ出力分配部11から送られてきた登録者の画像から顔の輪郭を検出し（S10）、その輪郭から目、鼻、及び口等の顔特有の特徴を示す領域の検出（S11）、更にこれらの相対関係を検出する（S12）。

【0026】特徴抽出部8では、前処理部7の出力を受けて、入力された顔画像の特徴を正規化し（S13）、コード化して顔貌パターンを生成する（S14）。このようにして生成された顔貌パターンは、登録者名、ID*

$$T = k * R_i + (1 - k) * R_f, \dots \dots (1) \text{式}$$

ここで、T：総合類似度、 R_i ：アイリスによる類似度、 R_f ：顔貌による類似度、k：定数（ $1 > k$ ）であり、この定数kは実験や統計的手法により適切な値を決定する。

【0032】この類似度結合部14で算出された総合類似度は総合判定部15に送出され、総合判定部15は総合類似度を1つあるいは複数のしきい値と比較し、入力

*番号、及び日付等の必要なデータが付加され、照合辞書部10に登録される（S15）。尚、アイリスパターンと顔貌パターンは、前記のようにそれぞれ照合辞書5、10に登録されるので、この両パターンは互いにリンクさせる必要があるが、リンクのためのデータとしては登録者名やID番号を利用することができる。

【0027】また、上述したアイリス認識部12でのS3~S9の処理と顔貌認識部13でのS10~S15の処理は並行して行われる。次に、図3の識別モードについて、同じくSで示したステップに従って説明する。

尚、このモードにおいて前記のように照合辞書部5、10にはそれぞれ複数人数人のアイリスパターン及び顔貌パターンが登録されているものとする。

【0028】まず、カメラ1による被識別者の映像入力からアイリス認識部12でのアイリスのコード化（S1~S8）、及び顔貌認識部13での顔貌のコード化（S1, S2, S10~S14）までの各処理が前記登録時と同様に行われる。そして、アイリス認識部12では、特徴抽出部3で生成されたアイリスパターンは照合部4に送られ、照合部4ではこの特徴抽出部3から送られてきたアイリスパターンと照合辞書部5に登録されているアイリスパターンを照合（マッチング）演算し、類似度を求めて（S9）、その結果を類似度結合部14に対して出力する。

【0029】尚、この場合の類似度の算出も従来と同様に行われる。一方、顔貌認識部13では、特徴抽出部8で生成された顔貌パターンが照合部9に送られ、照合部9では特徴抽出部8から送られてきた顔貌パターンを照合辞書部10に登録されている顔貌パターンと照合、演算し、類似度を求める（S15）。

【0030】この照合演算には、距離尺度等が使用され、そして照合部9は演算結果の類似度（距離値）を類似度結合部14に対して出力する。このようにしてアイリス認識部12と顔貌認識部13のそれぞれの照合部4、9においてアイリスパターンと顔貌パターンのそれぞれの照合が行われるが、この照合に用いられる照合辞書部5のアイリスパターンと顔貌パターンは必ず同一人物のパターンが使用されるように制御する。

【0031】次に類似度結合部14は、アイリス認識部12と顔貌認識部13のそれぞれの照合部4、9から受け取った2つの類似度を、以下の（1）式により結合して総合類似度を算出する（S16）

された映像から得られたアイリスパターン及び顔貌パターンが、照合辞書部5、10の中の照合したアイリスパターン及び顔貌パターンと同一人物のものかどうかを判定し（S17）、判定結果を出力する。

【0033】上述した図3の識別モードにおける照合処理では、次の2種類の形態が採用される。その1つは、被識別者の画像から得られたアイリスパターン及び顔貌

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パターンに対して、照合辞書部5及び10に登録されているアイリスパターン及び顔貌パターンのうちの照合すべきそれぞれパターンが判っている場合つまり1対1の照合であり、別の1つは、照合辞書部5、10に登録されているアイリスパターン及び顔貌パターンのうちの照合すべきパターンが判らず、登録されている複数のスパターンの中から最も確からしいアイリスパターン及び顔貌パターンを選択する場合つまり1対nの照合である。

【0034】1対1の照合の場合には、照合部4及び9は、それぞれ1つのアイリスパターン及び顔貌パターンを用いて類似度を算出し、それを類似度結合部14に対して出力する。1対nの照合の場合には、照合部4及び9は照合辞書部5及び10の中のそれぞれ複数のアイリスパターン及び顔貌パターンを用いて照合演算を行い、その第1位あるいは上位m位(mは任意の値)の類似度を類似度結合部14に対して送出する。

【0035】この場合、それぞれの照合部4及び9から受け取った第1位あるいは上位m位の類似度が同一人物のものでないことがありうるが、その場合には類似度結合部14が、十分確からしくないとして総合判定部15に通知することによって、被識別者の画像から得られたアイリスパターン及び顔貌パターンが、照合に用いたアイリスパターン及び顔貌パターンと同一人物のものでないと判定することができる。

【0036】以上説明した、第1の実施の形態によれば、アイリス認識に加えて顔貌認識を行い、個人特定の識別を両認識の類似度を用いることによって行っているため、被識別者に無理な姿勢を強いたり、周囲の照明条件に厳しい制限を加えたりすることなく、かつ画素数の多いカメラを使用することなく、確実な識別が可能で、高い識別率を得ることができる。

【0037】図4は第2の実施の形態の構成を示すブロック図である。この第2の実施の形態は、総合判定部15をアイリス認識部12と顔貌認識部13の各々の照合部4及び9に接続し、この総合判定部15に類似度結合部14を接続したもので、その他の構成については第1の実施の形態と同じである。この第2の実施の形態も登録モードと識別モードの2種類のモードにて動作するが、登録モードは第1の実施の形態と同様であるので、ここでは作用として識別モードのみにについて説明する。

【0038】図5は第2の実施の形態の識別モードを示すフローチャートで、Sで示したステップに従って説明する。この識別モードにおいてS1～S15までの処理は第1の実施の形態と同様に行われるのでその説明は省略するが、S9及びS15での照合は、登録辞書部5及び10に登録されているアイリスパターン及び顔貌パターンのうちの照合すべきパターンが判らず、それぞれ複数のパターンの中から、最も確からしいパターンを選択する場合つまり1対nの照合が適用される。

【0039】また、この第2の実施の形態と第1の実施

の形態の動作上の差異は総合判定部15と類似度結合部14による判定法の差である。すなわち、総合判定部15は、アイリス認識部12及び顔貌認識部13のそれぞれの照合部4及び9から、アイリスパターン及び顔貌パターンの上位n位までの類似度を受け取ると、まずアイリスパターンのn位までの類似度のそれぞれの差を算出する(S16)。

【0040】次に、その差を予め実験や統計的手法を用いて定めたしきい値aによって判定し(S17)、差がしきい値a以上の場合、アイリスパターンの類似度のみを用いて総合判定を行うが、その差がしきい値a以下の場合、次のステップである総合類似度算出に進む。例えば、アイリス認識部12の照合部4から、第2位までの類似度が総合判定部15へ入力された場合、総合判定部15では入力された第1位と第2位との類似度の差を求め、この差が予め設定したしきい値aより大きい場合、第1位の類似度を示すアイリスパターンが充分確からしいとして、総合判定へと進む。

【0041】また、その差がaよりも小さい場合、第1位として上がってきたものは、充分確からしいとは言えないため、アイリス認識部12からの類似度のみでは判定せず、次の類似度結合部と進む。アイリスパターンの上位n位の差が、しきい値aよりも小さい場合、総合判定部15は類似度結合部14に対してアイリスパターン及び顔貌パターンの上位n位の類似度を転送し、これを受けて類似度結合部14は、第1の実施の形態で説明した(1)式を用いて双方の類似度を結合し、総合類似度を算出して、その算出結果を総合判定部15に転送する(S18)。

【0042】総合判定部15は類似度結合部14から総合類似度を受けると、その総合類似度を1つあるいは複数のしきい値と比較して判定し(S19)、その判定結果を出力する。つまり、被識別者の映像から得られたアイリスパターン及び顔貌パターンが、照合辞書部5、10の中の照合したアイリスパターン及び顔貌パターンと同一人物のものか否かを判定し、その判定結果を出力する。

【0043】以上述べた第2の実施の形態においても、第1の実施例と同様に安定した高い認識率を得ることができ、しかもこの第2の実施の形態では、アイリスパターンが十分に確からしいと判定された場合には、顔貌パターンの類似度を使用することなく被識別者の識別を行うため、処理の高速化を図ることができる。図6は第3の実施の形態の構成を示すブロック図である。

【0044】この実施の形態では、アイリス認識部12と前処理部2と特徴抽出部3で構成され、また顔貌認識部13も前処理部7と特徴抽出部8で構成されていて、両特徴抽出部2、8が特徴結合部14に接続されている。そして、特徴結合部14と総合判定部15の間に照合部16が設けられ、この照合部16と特徴結合部14

に照合辞書部17が設けられた構成となっている。

【0045】尚、カメラ1で撮影した画像をカメラ出力分配部11によりアイリス認識部12と顔貌認識部13のそれぞれの前処理部2, 7の送出することは第1, 第2の実施の形態と同じである。この第3の実施の形態も登録モードと識別モードの2種類のモードにて動作するもので、図7は登録モードのフローチャートであり、図8は識別モードのフローチャートである。

【0046】この両モードにおいて、それぞれアイリス認識部12と顔貌認識部13の特徴抽出以降に特徴がある。まず、登録モードについて説明すると、。カメラ1による被識別者の映像入力からアイリス認識部12でのアイリスのコード化(S1~S8)、及び顔貌認識部13での顔貌のコード化(S1, S2, S9~S13)までの各処理は第1, 第2の実施の形態と同様に行われる。

【0047】アイリス認識部12の特徴抽出部3及び顔貌認識部13の特徴抽出部8でコード化されたアイリスパターン及び顔貌パターンは特徴結合部14に送られ、この特徴結合部5で結合されて特徴パターンが作られる(S14)。この場合の結合の方法としては、1次元のベクトル配置を採用する。結合された特徴パターンは、登録者名、ID番号、日付等の必要なデータが付加され、照合辞書部17に登録される(S15)。

【0048】次に、識別モードについて説明する。このモードにおいても照合辞書部17にそれぞれ複数の人の特徴パターンが登録されているものとする。また、この識別モードにおいてS1の映像入力からS13のコード化までの処理は第1, 第2の実施の形態及び前記図7の登録モードの場合と同様に行われ、そしてS14の特徴結合も図7の登録モードの場合と同様に行われるのでその説明は省略する。

【0049】特徴結合部14で特徴結合されたアイリスパターンと顔貌パターンとの特徴パターンは照合部16に送られ、この照合部16において照合辞書部17に登録されている特徴パターンと照合、演算が行われて類似度が算出される(S15)。この場合の照合演算にもハミング距離等の距離尺度が用いられる。照合部16で算出された類似度(距離値)は総合判定部15に送られ、この総合判定部15では、照合部16によって得られた類似度を予め実験や統計的手法によって求めた1つあるいは複数のしきい値と比較し、入力された映像から得られた特徴パターンが、照合辞書部17の中の照合した特徴パターンと同一人物のものかどうかを判定し(S16)、その判定結果を出力する。

【0050】上述した図8の識別モードにおける照合処理でも、次の2種類の形態が採用される。その1つは、照合辞書部17に登録されている特徴パターンのうちの照合すべき特徴パターンが判っている場合つまり1対1の照合であり、別の1つは、照合すべき特徴パターンが

判らず、登録されている複数人の特徴パターンの中から最も確からしい特徴パターンを選択する場合つまり1対nの照合である。

【0051】1対1の照合の場合には、照合部16は照合辞書部17に登録されている1つの特徴パターンを用いて類似度を算出し、それを総合判定部15に対して出力する。総合判定部15による判定では、類似度を1つあるいは複数のしきい値と比較し、入力された映像から得られた特徴パターンが照合した特徴パターンと同一人物のものかどうかの判定つまり個人識別を行い、その結果を出力する。

【0052】1対nの照合の場合には、照合部16は照合辞書部17に登録されている複数の特徴パターンを用いて照合演算を行い、その第1位あるいは上位m位(mは任意の値)の類似度を総合判定部15に対して出力する。この場合、総合判定部15による判定では、第1位あるいは上位m位の類似度類似度を1つあるいは複数のしきい値と比較し、被識別者の画像から得られた特徴パターンが照合したどの特徴パターンに最も類似しているか、あるいは十分に類似していないかなどにより、特徴パターンと同一人物のものかどうかの判定つまり個人識別を行い、その結果を出力する。

【0053】以上説明した第3の実施の形態によれば、第1の実施例と同様に安定した高い認識率を得ることができ、しかもこの第3の実施の形態では、照合部と照合辞書部がそれぞれ1つで済むので構成が簡素化される利点がある。図9は第4の実施の形態の構成を示すブロック図である。この実施の形態は、第1の実施の形態におけるカメラ1とカメラ出力分配部11に代えて、アイリス用カメラ18と顔貌用カメラ19とを用い、アイリス用カメラ18をアイリス認識部12の前処理部2に、また顔貌用カメラ19を顔貌認識部13の前処理部7にそれぞれ接続したもので、その他の構成は第1の実施の形態と同様に構成している。

【0054】従って、この実施の形態では登録モード及び識別モード時に被識別者の画像がアイリス用カメラ18と顔貌用カメラ19でそれぞれ撮影され、前処理部2, 7に別々に送られるが、それ以後の処理は第1の実施の形態と同様に行われる。このようにした第4の実施の形態でも第1の実施の形態と同様の効果が得られると共に、映像入力用のカメラをアイリス認識用と顔貌認識用の2台に分けたことによって、それぞれの認識に適応したカメラを使用することができる。

【0055】例えば、アイリス認識用には高解像度で狭角のカメラ、顔貌認識用には低解像度で広角のカメラを使用することができ、そのため高価で大型の1台のカメラを使用する場合に比べて、装置の識別性能を落とすことなく、低価格化、小型化を図ることができる。図10は第5の実施の形態の構成を示すブロック図、図11は第6の実施の形態の構成を示すブロック図である。

【0056】この両実施の形態も、第2、3の実施の形態におけるカメラ1とカメラ出力分配部11に代えて、アイリス用カメラ18と顔貌用カメラ19とを用い、アイリス用カメラ18をアイリス認識部12の前処理部2に、また顔貌用カメラ19を顔貌認識部13の前処理部7にそれぞれ接続したもので、その他の構成は第2、3の実施の形態と同様に構成している。

【0057】従って、この両実施の形態でも登録モード及び識別モード時に被識別者の画像がアイリス用カメラ18と顔貌用カメラ19でそれぞれ撮影され、前処理部2、7に別々に送られるが、それ以後の処理は第2、3の実施の形態と同様に行われる。このようにした第5、第6の実施の形態でもそれぞれ第2、3の実施の形態と同様の効果が得られると共に、第4の実施の形態と同様に映像入力用のカメラをアイリス認識用と顔貌認識用の2台に分けたことによって、それぞれの認識に適応したカメラを使用することができるので、装置の識別性能を落とすことなく、低価格化、小型化を図ることができる。

【0058】

【発明の効果】以上説明したように本発明は、被識別者を撮影し、その画像から特徴抽出して得たアイリスパターン及び顔貌パターンを、予め登録されているアイリスパターン及び顔貌パターンと照合してそれぞれの類似度を求め、このアイリスパターンの類似度と顔貌パターンの類似度を結合して、その結合結果に基づいて被識別者の画像から得たアイリスパターン及び顔貌パターンが照合に用いたアイリスパターン及び顔貌パターンと同一人物のものか否かを判定するようにしている。

【0059】従ってこれによれば、アイリス認識に加え顔貌認識を行い、個人特定の識別を両認識の類似度を用いることによって行っているため、被識別者に無理な姿勢を強いたり、周囲の照明条件に厳しい制限を加えたりすることなく、かつ画素数の多いカメラを使用することなく、確実な識別が可能となり、高い識別率を得ることができるという効果が得られる。

【図面の簡単な説明】

【図1】本発明による個人識別装置の第1の実施の形態を示すブロック図である。

【図2】第1の実施の形態の作用を示すフローチャートである。

【図3】第1の実施の形態の作用を示すフローチャート*

*である。

【図4】本発明による個人識別装置の第2の実施の形態を示すブロック図である。

【図5】第2の実施の形態の作用を示すフローチャートである。

【図6】本発明による個人識別装置の第3の実施の形態を示すブロック図である。

【図7】第3の実施の形態の作用を示すフローチャートである。

【図8】第3の実施の形態の作用を示すフローチャートである。

【図9】本発明による個人識別装置の第4の実施の形態を示すブロック図である。

【図10】本発明による個人識別装置の第5の実施の形態を示すブロック図である。

【図11】本発明による個人識別装置の第6の実施の形態を示すブロック図である。

【図12】従来技術を示すブロック図である。

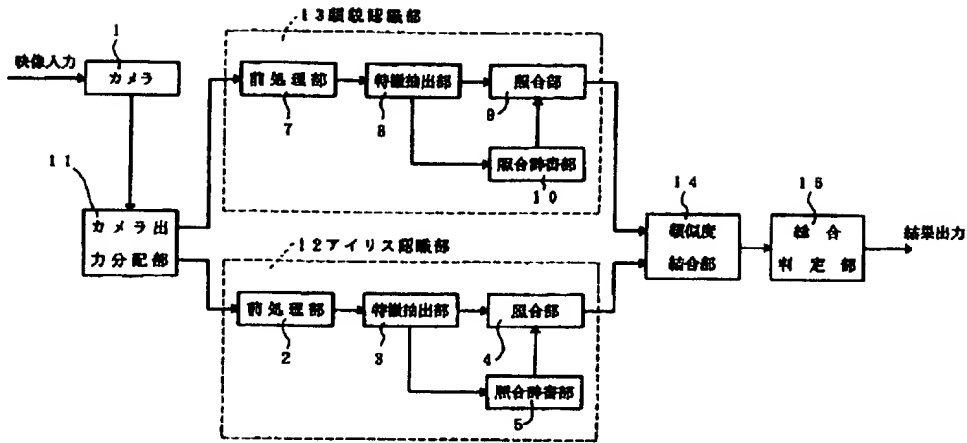
【図13】従来技術の作用を示すフローチャートである。

【図14】従来技術の作用を示すフローチャートである。

【符号の説明】

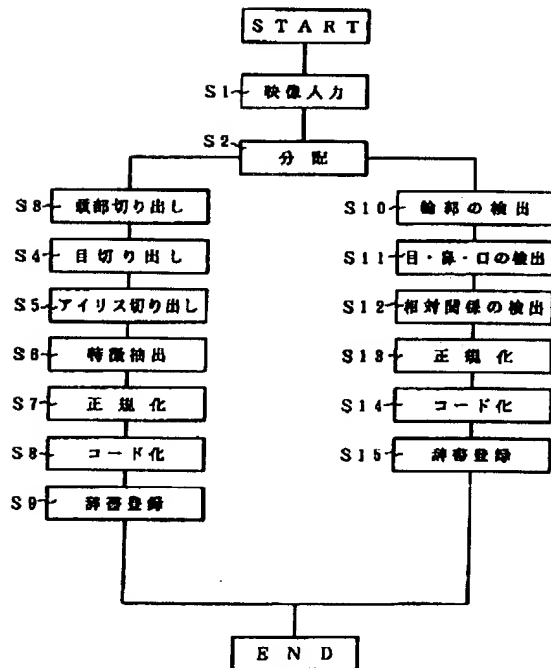
- 1 カメラ
- 2 前処理部
- 3 特徴抽出部
- 4 照合部
- 5 照合辞書部
- 7 前処理部
- 8 特徴抽出部
- 9 照合部
- 10 照合辞書部
- 11 カメラ出力分配部
- 12 アイリス認識部
- 13 顔貌認識部
- 14 類似度結合部
- 15 総合判定部
- 16 照合部
- 17 照合辞書部
- 18 アイリス用カメラ
- 19 顔貌用カメラ

【図1】



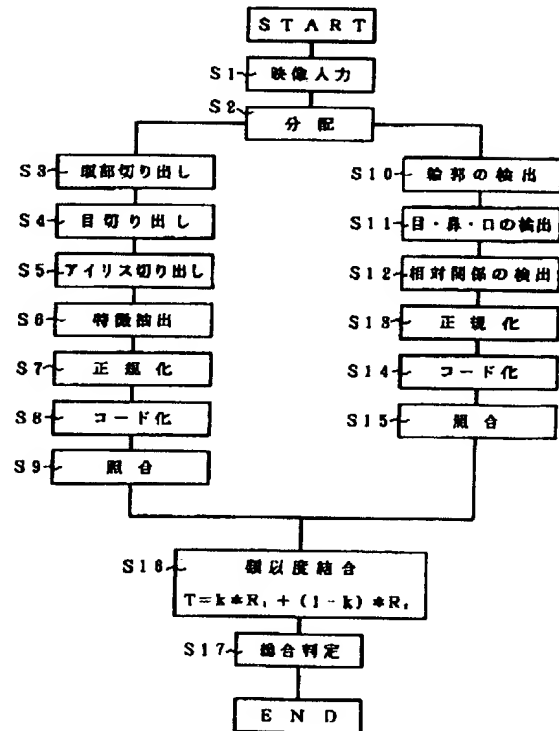
本発明の第1の実施の形態を示すブロック図

【図2】



第1の実施の形態の作用を示すフローチャート（登録）

【図3】



第1の実施の形態の作用を示すフローチャート（識別）

```

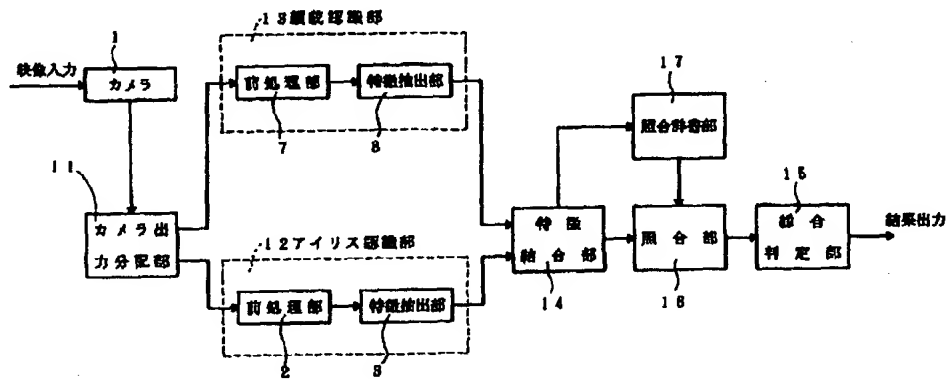
graph TD
    START([START]) --> S1[S1 映像入力]
    S1 --> S2[S2 分配]
    S2 --> S3[S3 顔部切り出し]
    S2 --> S10[S10 輪郭の検出]
    S3 --> S4[S4 目切り出し]
    S4 --> S5[S5 アイリス切り出し]
    S5 --> S6[S6 特徴抽出]
    S6 --> S7[S7 正規化]
    S7 --> S8[S8 コード化]
    S8 --> S9[S9 照合]
    S10 --> S11[S11 目・鼻・口の検出]
    S11 --> S12[S12 相対関係の検出]
    S12 --> S13[S13 正規化]
    S13 --> S14[S14 コード化]
    S14 --> S15[S15 照合]
    S9 --> S16[S16 アイリス認識類似度上位 n 位の値を算出]
    S15 --> S16
    S16 --> S17{S17 差はしきい値 α 以上か?}
    S17 -- YES --> S19[S19 適合判定]
    S17 -- NO --> S18[S18 適合類似度算出]
    S18 --> S19
    S19 --> END([END])
  
```

```

graph TD
    START[START] --> S1[S1 映像入力]
    S1 --> S2[S2 分配]
    S2 --> S3[S3 顔部切り出し]
    S2 --> S9[S9 輪郭の検出]
    S3 --> S4[S4 目切り出し]
    S4 --> S5[S5 アイリス切り出し]
    S5 --> S6[S6 特徴抽出]
    S6 --> S7[S7 正規化]
    S7 --> S8[S8 コード化]
    S9 --> S10[S10 目・鼻・口の検出]
    S10 --> S11[S11 相対関係の検出]
    S11 --> S12[S12 正規化]
    S12 --> S13[S13 コード化]
    S8 --> S14[S14 特徴結合]
    S13 --> S14
    S14 --> S15[S15 辞書登録]
    S15 --> END[END]
  
```

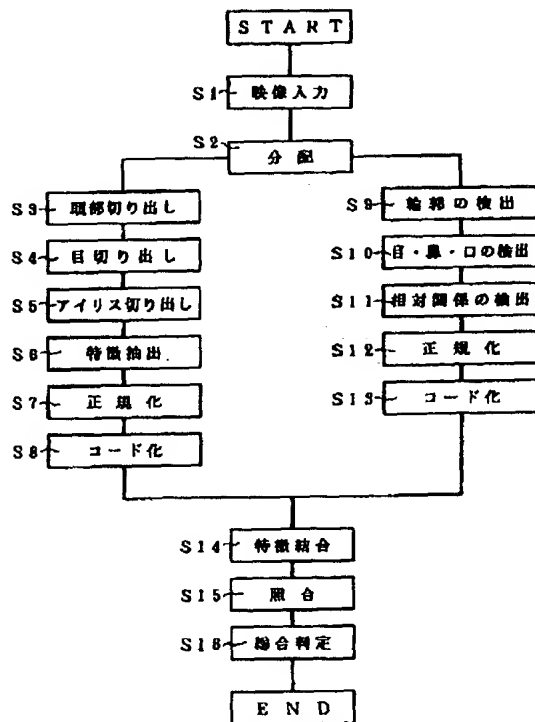
第3の実施の形態の作用を示すフローチャート（登録）

【図6】



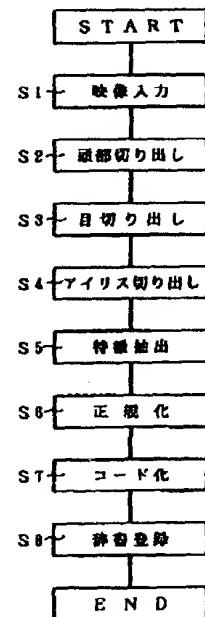
第3の実施の形態を示すブロック図

【図8】



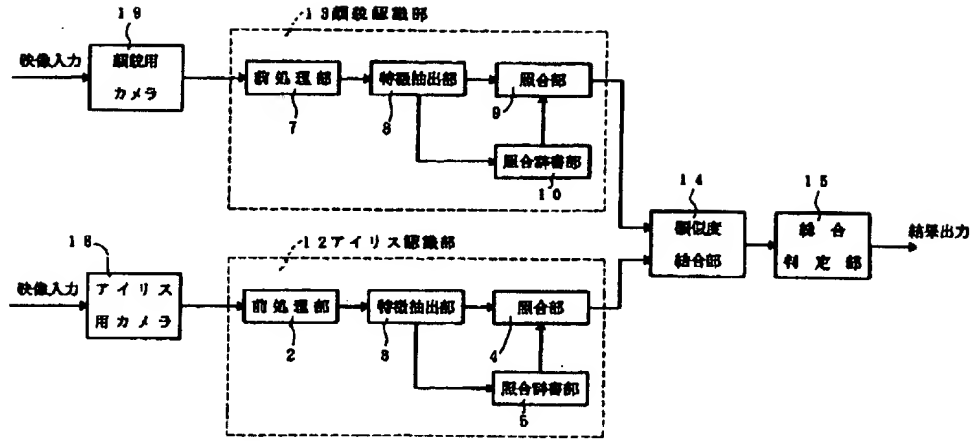
第3の実施の形態の作用を示すフローチャート（総論）

【図13】



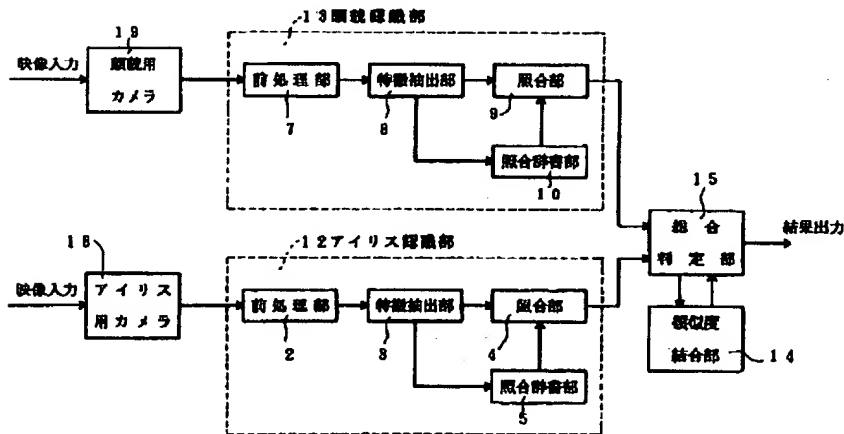
従来技術の作用を示すフローチャート（登録）

【図9】



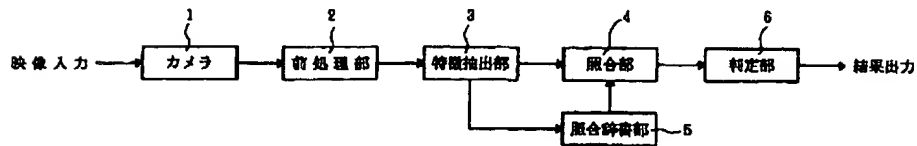
第4の実施の形態を示すブロック図

【図10】



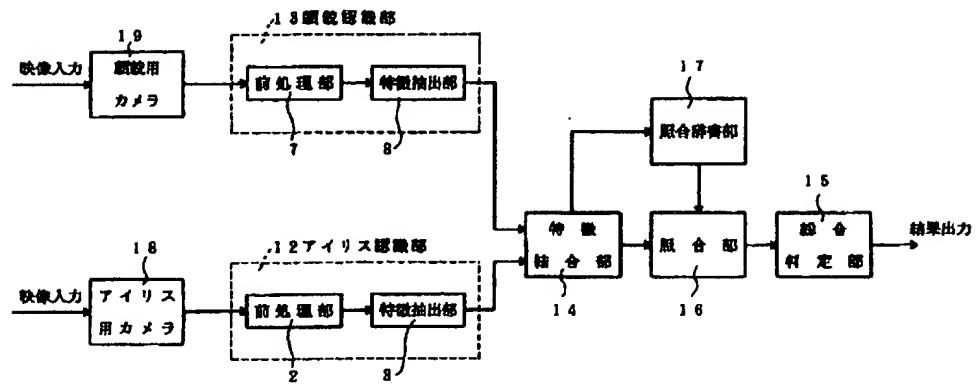
第5の実施の形態を示すブロック図

【図12】



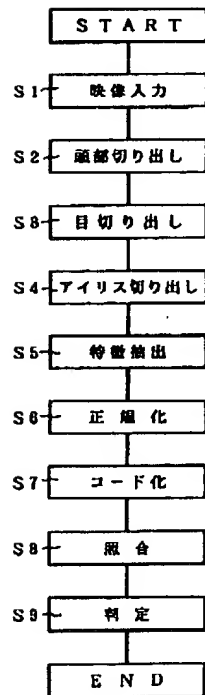
従来技術を示すブロック図

【図11】



第6の実施の形態を示すブロック図

【図14】



従来技術の作用を示すフローチャート（認識）

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CLAIMS

[Claim(s)]

[Claim 1] The iris pattern and facies pattern which carried out the feature extraction and which photoed the identified person, and were obtained from the image Collate with the iris pattern and facies pattern which are registered beforehand, ask for each similarity, and the similarity of this iris pattern and the similarity of a facies pattern are combined. Identification equipment with which the iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result are characterized by judging whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[Claim 2] The pretreatment section which cuts down an iris in identification equipment according to claim 1 from the camera which photos a person, and the image which this camera photoed, The feature-extraction section which extracts the description of the iris cut down by this pretreatment section, and obtains an iris pattern, The collating dictionary section which registers the iris pattern obtained by this feature-extraction section at the time of registration, And the iris recognition section which has the collating section which collates the iris pattern obtained by the feature-extraction section at the time of discernment with the iris pattern registered into said collating dictionary section, and asks for similarity, The pretreatment section which detects the field which shows the profile and the description of a face, its relative relation, etc. from the image which said camera photoed, The feature-extraction section which extracts the description of the facies detected by this pretreatment section, and obtains a facies pattern, The collating dictionary section which registers the facies pattern obtained by this feature-extraction section at the time of registration, And the facies recognition section which has the collating section which collates the facies pattern obtained by the feature-extraction section at the time of discernment with the facies registered into said collating dictionary section, and asks for similarity, The similarity bond part which combines the similarity of the iris pattern sent from each collating section of said iris recognition section and the facies recognition section, and the similarity of a facies pattern, Identification equipment characterized by equipping the iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result sent from this similarity bond part with the comprehensive judgment section which judges whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[Claim 3] The iris pattern and facies pattern which carried out the feature extraction and which photoed the identified person, and were obtained from the image Collate with the iris pattern and facies pattern which are registered beforehand, and it asks for similarity, respectively. It judges whether it is the iris pattern same person's thing which the iris pattern obtained from the image of an identified person by the similarity of an iris pattern used for collating. When not belonging to the same person, the similarity of an iris pattern and the similarity of a facies pattern are combined. Identification equipment with which the iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result are characterized by judging whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[Claim 4] The pretreatment section which cuts down an iris in identification equipment according to claim 3 from the camera which photos a person, and the image which this camera photoed, The feature-extraction section which extracts the description of the iris cut down by this pretreatment section, and obtains an iris pattern, The collating dictionary section which registers the iris pattern obtained by this feature-extraction section at the time of registration, And the iris recognition section which has the

collating section which collates the iris pattern obtained by the feature-extraction section at the time of discernment with the iris pattern registered into said collating dictionary section, and asks for similarity, The pretreatment section which detects the field which shows the profile and the description of a face, its relative relation, etc. from the image which said camera photoed, The feature-extraction section which extracts the description of the facies detected by this pretreatment section, and obtains a facies pattern, The collating dictionary section which registers the facies pattern obtained by this feature-extraction section at the time of registration, And the facies recognition section which has the collating section which collates the facies pattern obtained by the feature-extraction section at the time of discernment with the facies pattern registered into said collating dictionary section, and asks for similarity, The similarity bond part which combines the similarity of the iris pattern sent through the comprehensive judgment section from each collating section of said iris recognition section and the facies recognition section, and the similarity of a facies pattern, It judges whether it is the iris pattern same person's thing which the iris pattern obtained from the image of an identified person by the similarity of the iris pattern sent from the collating section of said iris recognition section used for collating. When not belonging to the same person, the similarity of said iris pattern and the similarity of the facies pattern sent from the collating section of said facies recognition section are combined by said similarity bond part. Identification equipment characterized by equipping the iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result with the comprehensive judgment section which judges whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[Claim 5] It sets to claim 1 and identification equipment given in three, and is the $T = k \cdot RI + (1 - k) \cdot RfT$: synthesis similarity RI about the similarity of an iris pattern, and the similarity of a facies pattern. : Similarity Rf by the iris : Similarity k by facies: Constant ($1 > k$) Identification equipment characterized by joining together by the formula to say.

[Claim 6] The identification equipment with which the description pattern which photoed an identified person, combined the iris pattern and the facies pattern which carried out a feature extraction, and which obtained from that image, made a description pattern, collated this description pattern with the description pattern registered beforehand, asked for similarity, and obtained from the image of an identified person based on that similarity is characterized by to judge whether it is the thing of the description pattern which used for collating, and the same person.

[Claim 7] The pretreatment section which cuts down an iris in identification equipment according to claim 6 from the camera which photos a person, and the image which this camera photoed, And the iris recognition section which has the feature-extraction section which extracts the description of the iris cut down by this pretreatment section, and obtains an iris pattern, The pretreatment section which detects the field which shows the profile and the description of a face from the image which said camera photoed, its relative relation, etc., and the facies recognition section which has the feature-extraction section which extracts the description of the facies detected by this pretreatment section, and obtains a facies pattern, The description bond part which combines the iris pattern and facies pattern which are sent from each feature-extraction section of said iris recognition section and the facies recognition section, and makes the description pattern, The collating dictionary section which registers the description pattern made from this description bond part at the time of registration, the description pattern registered into said collating dictionary section in the description pattern sent from said description bond part at the time of discernment -- joining together -- ** -- with the collating section which collates and asks for similarity Identification equipment characterized by equipping the description pattern obtained from the image of an identified person based on the similarity sent from this collating section with the comprehensive judgment section which judges whether it is the thing of the description pattern used for collating, and the same person.

[Claim 8] Identification equipment characterized by joining together by the vector of an iris pattern and a facies pattern in identification equipment according to claim 6.

[Claim 9] Identification equipment which makes one set the camera which photos a person in claim 2, claim 4, and identification equipment according to claim 7, and is characterized by having the camera output distribution section which distributes the output of this camera to both the iris recognition section and the facies recognition section.

[Claim 10] the identification equipment characterized by sending the image which photoed the image which resembled claim 2, claim 4, and identification equipment according to claim 7, set, was equipped

2.

· with the camera for irises, and the camera for facies, and was photoed with the camera for irises with
· delivery and the ** camera for facies in the iris recognition section to the facies recognition section.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the identification equipment which identifies an individual using human being's ecological description, especially the iris of an eyeball.

[0002]

[Description of the Prior Art] When Consumer Transaction Facility performs dealings actuation in a financial institution, or when accessing the data which have secreting nature by computer etc., identification for checking the existence of the rating in the case of entrance to the facility which only further specific human being puts in etc. is performed.

[0003] The thing of current versatility can be considered as a technique of this identification, or although it carries out, there is a technique of identifying an individual using that iris that is some human being's eyeballs as one. Since there is the description of it being completed at infancy, and this iris hardly changing through a lifetime, and being [which grows fat] hard to be influenced of change by the physique of becoming thin, application in the direction of many will be expected highly [discernment precision] therefore in the future.

[0004] Drawing 12 is the functional block diagram showing the conventional common identification equipment using an iris. The pretreatment section which performs from the camera (video camera) with which 1 performs an image input in drawing, and the image by which 2 was photoed with this camera 1, the processing, i.e., pretreatment, which cuts down an iris, 3 is the feature-extraction section which extracts the description of the iris cut down by this pretreatment section 2, and codes that pattern. 4 is the collating section which collates the iris pattern which has registered into the collating dictionary section 5 the iris pattern sent from this feature-extraction section 3, and asks for the similarity between both, and two or more iris patterns for manpower are beforehand stored in the collating dictionary section 5 here. 24

[0005] 6 is the judgment section both the iris pattern judges whether it is the same person's thing from the similarity computed by the collating section 4 to be. In this configuration, as for the pretreatment section 2, the feature-extraction section 3, the collating section 4, and the judgment section 6, being constituted by a microprocessor and exclusive operation hardware is common, and it is [the collating dictionary section 5] common to consist of semiconductor memory, a magnetic disk, etc.

[0006] Next, an operation of a configuration of having mentioned above is explained. Drawing 13 is a flow chart which shows the procedure at the time of the register mode of an iris pattern, and drawing 14 is a flow chart which shows the procedure in the discernment mode of an iris pattern. First, the register mode of drawing 13 is explained according to the step shown by S.

[0007] The image of the upper half of the body of those, who should register, is photoed with a camera 1. That is, an image input is carried out (S1). Next, the photoed image is sent to the pretreatment section 2, logging (indexing of the location of a head) of a head is performed from the image of an identified person in this pretreatment section 2 (S2), and processing which cuts down an iris from logging (indexing of the location of an eye) (S3) of an eye and the image of this eye (indexing of the location of an iris) is further performed in the sequential pretreatment section 2 from the image of this head (S4).

[0008] The image of this cut-down iris is sent to the feature-extraction section 3, and the description required for collating is extracted in the feature-extraction section 3 (S5). An iris is divided into a required analysis band, or, specifically, the feature extraction of the Gabor filter etc. extracting 4.

concentration change of an iris is performed. And it normalizes the description of the extracted iris in the feature-extraction section 3 (S6), it is coded as binary data (S7), and about 256 bytes of iris code is eventually generated as an iris pattern.

[0009] Thus, required data, such as a registrant name, an ID number, and a date, are added, and the generated iris pattern is registered into the collating dictionary section 5 (S8). Next, the discernment mode of drawing 14 is explained according to the step similarly shown by S. In addition, in this mode, two or more men's iris pattern shall be registered into the above by the collating dictionary section 5 like.

[0010] First, the image input (S1) of an identified person, logging (S2) of a head, logging of an eye (S3), And after being carried out in order in the pretreatment section 2 like the case where it is each processing of an iris of logging (S4) at said registration time, It is carried out in the feature-extraction section 3 like the case where it is each processing of the feature extraction (S5) of an iris, normalization (S6), and coding (S7) at said registration time, and an iris pattern is generated.

[0011] The generated iris pattern is sent to the collating section 4, and in the collating section 4, the collating (matching) operation of the iris pattern sent from this feature-extraction section 3 and the iris pattern registered into the collating dictionary section 5 is carried out, and it asks for similarity (S8). By the collating operation in this case, distance values, such as the Hamming distance, are well used as a scale of similarity.

[0012] The similarity (distance value) of the iris pattern chosen by collating in this collating section 4 is transmitted to the judgment section 6. In the judgment section 6, the iris pattern obtained from the image of an identified person by the experiment or the statistical method as compared with one or more thresholds calculated beforehand judges that it is the thing of the iris pattern with which the sent similarity was collated in the collating dictionary section 5, and the same person (S9).

[0013] In addition, although it can be freely chosen [certain] now which code (who) registered into the collating dictionary 5 as an object for collating is used or whether it is, and it crawls and the pattern (how many persons) of shoes is used and it is determined by the specification of a system in the collating processing in this discernment mode, it divides roughly and two kinds of gestalten as follows are adopted. As opposed to the iris pattern with which one of them was obtained from the image of an identified person When the pattern which should collate of the iris patterns registered into the collating dictionary section 5 is known that is, it is collating of 1 to 1. One [another] When the pattern which should collate of the iris patterns registered into the collating dictionary section 5 is not known but it chooses the probable iris pattern out of two or more persons' iris pattern registered that is, it is collating of one pair n.

[0014] In collating of 1 to 1, the collating section 4 computes similarity using one iris pattern, and outputs the calculation result to it to the judgment section 6. In the judgment in this case, it identifies whether the iris pattern with which the iris pattern obtained from the image of an identified person collated similarity as compared with one or more thresholds belongs to the same person.

[0015] In collating of one pair n, the collating section 4 collates two or more iris patterns in the collating dictionary section 5, performs a collating operation, and sends out the high order [the 1st place or the m-th place of a high order (m is any value)] similarity at the judgment section 6. In this case, the judgment section 6 judges the similarity of the 1st place or the m-th place of a high order with one or more thresholds, investigates whether the iris pattern obtained from the image of an identified person is most similar to which collated iris pattern, or it is not fully similar, and identifies whether the iris pattern collated with the iris pattern obtained from the image of an identified person belongs to the same person.

[0016]

[Problem(s) to be Solved by the Invention] However, with the identification equipment of the iris utilization mentioned above, in recognition equipment, when an identified person did not wink at the time of photography or the data of an exact iris were not obtained by the instability of the image acquisition by the lighting conditions of the instability of the image by the thing, like the hair of hair starts an eye, or a perimeter etc., positive discernment became difficult and there was a problem that where of the rate of discernment fell.

[0017] When solving such a problem, it has been strong enough in the position with an identified person impossible for in order to obtain stabilization of an image, and the increment in a throughput, enlargement of equipment, the formation of an expensive rank, the increment in power consumption,

5.

etc. will no longer be avoided, and it will become not realistic to add a severe limit to surrounding lighting conditions, if a camera with many pixels is used in order to gather a recognition rate desirable still more simply on a human interface.

[0018] Therefore, it has been strong enough in the position with an identified person impossible for, and positive discernment is possible for the technical problem of the invention in this application, without [without it adds a severe limit to surrounding lighting conditions, and] using a camera with many pixels, and it is realizing the identification equipment with which the high rate of discernment is obtained.

[0019]

[Means for Solving the Problem] Therefore, the iris pattern and facies pattern which carried out the feature extraction and which this invention photoed the identified person, and were obtained from the image Collate with the iris pattern and facies pattern which are registered beforehand, ask for each similarity, and the similarity of this iris pattern and the similarity of a facies pattern are combined. The iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result are characterized by judging whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[0020]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of this invention is explained below. Drawing 1 is the block diagram showing the configuration of the 1st of the gestalt of operation of the identification equipment by this invention. This identification unit is constituted by the camera 1 which photos a person, the camera output distribution section 11, the iris recognition section 12, the facies recognition section 13, the similarity bond part 14, and the comprehensive judgment section 15.

[0021] Here, the camera output distribution section 11 undergoes the output from a camera 1, and sends out the output to the iris recognition section 12 and the facies recognition section 13, respectively. The iris recognition section 12 consists of the pretreatment section 2, the feature-extraction section 3, the collating section 4, and the collating dictionary section 5, and the facies recognition section 13 is also constituted by the pretreatment section 7, the feature-extraction section 8, the collating section 9, and the collating dictionary section 10.

[0022] Each part of 2-4 in the iris recognition section 12 is the same as that of the component shown in drawing 13 , and each part of 7-10 of the facies recognition section 13 is equivalent to the thing of 2-4. It is what the similarity bond part 14 receives each similarity from the collating section 4 of the iris recognition section 12, and the collating section 10 of the facies recognition section 13, computes comprehensive similarity, and is sent out to the comprehensive judgment section 6 on the other hand.

An identified person judges whether you are the person registered into the collating dictionary section 10 of the collating dictionary section 5 of the iris recognition section 12, and the facies recognition section 13 from the comprehensive similarity sent from the similarity bond part 14, and the comprehensive judgment section 15 outputs the judgment result.

[0023] Next, an operation of the equipment by such configuration is explained. This equipment operates in the two modes, register mode and discernment mode, drawing 2 is the flow chart of register mode, and drawing 3 is the flow chart in discernment mode. First, the register mode of drawing 2 is explained according to the step shown by S.

[0024] The image of the upper half of the body of those (registrant), who should register, is photoed with a camera 1. That is, an image input is carried out (S1). The output of this camera 1 is sent to the camera output distribution section 1, and the image photoed by this camera output distribution section 1 with the camera 1 is distributed to each pretreatment section 2 and 7 of the iris recognition section 12 and the facies recognition section 13 (S2).

[0025] In the iris recognition section 12, each processing of logging (S3) of a head, logging (S4) of an eye, logging (S5) of an iris, the feature extraction (S6) of an iris, normalization (S7), and coding (S8) is performed by the pretreatment section 2 and the feature-extraction section 3 as usual, and an iris pattern is registered into the collating dictionary section 5 (S9). detection (S11) of the field which the pretreatment section 7 detects the profile of a face in the facies recognition section 13 on the other hand from a registrant's image sent from the camera output distribution section 11 (S10), and shows the description peculiar to faces, such as an eye, a nose, and opening, from the profile -- these relative relation is detected further (S12).

[0026] In the feature-extraction section 8, the description of the inputted face image is normalized and (S13) coded in response to the output of the pretreatment section 7, and a facies pattern is generated (S14). Thus, required data, such as a registrant name, an ID number, and a date, are added, and the generated facies pattern is registered into the collating dictionary section 10 (S15). In addition, although it is necessary to make both this pattern of each other link since an iris pattern and a facies pattern are registered into the collating dictionaries 5 and 10 as mentioned above, respectively, a registrant name and an ID number can be used as data for a link.

[0027] Moreover, processing of the 12 iris recognition section S3 - S9 mentioned above and processing of S10-S15 in the facies recognition section 13 are performed in parallel. Next, the discernment mode of drawing 3 is explained according to the step similarly shown by S. In addition, in this mode, two or more a manpower man's iris patterns and facies patterns shall be registered into the above by the collating dictionary sections 5 and 10 like, respectively.

[0028] First, each processing from the image input of an identified person with a camera 1 to coding (S1-S8) of the iris in the iris recognition section 12 and coding (S1, S2, S10-S14) of the facies in the facies recognition section 13 is performed like the time of said registration. And in the iris recognition section 12, the iris pattern generated in the feature-extraction section 3 is sent to the collating section 4, in the collating section 4, carries out the collating (matching) operation of the iris pattern sent from this feature-extraction section 3, and the iris pattern registered into the collating dictionary section 5, and outputs (S9) and its result to the similarity bond part 14 in quest of similarity.

[0029] In addition, calculation of the similarity in this case is also performed as usual. On the other hand, in the facies recognition section 13, the facies pattern generated in the feature-extraction section 8 is sent to the collating section 9, and in the collating section 9, it collates [the facies pattern registered into the collating dictionary section 10, and], the facies pattern sent from the feature-extraction section 8 is calculated, and it asks for similarity (S15).

[0030] An interval scale etc. is used for this collating operation, and the collating section 9 outputs the similarity (distance value) of the result of an operation to it to the similarity bond part 14. Thus, although each collating of an iris pattern and a facies pattern is performed in each collating section 4 and 9 of the iris recognition section 12 and the facies recognition section 13, the iris pattern and facies pattern of the collating dictionary section 5 which are used for this collating are controlled so that the same person's pattern is surely used.

[0031] Next, the similarity bond part 14 computes comprehensive similarity by combining two similarity received from each collating section 4 and 9 of the iris recognition section 12 and the facies recognition section 13 by the following (1) types (S16).

$T = k * RI + (1 - k) * Rf$ (1) type -- here -- T: synthesis similarity and RI : The similarity by the iris, and Rf : It is the similarity by facies, and k: constant ($1 > k$), and this constant k determines a suitable value with an experiment or a statistical method.

[0032] The comprehensive similarity computed by this similarity bond part 14 is sent out to the comprehensive judgment section 15, the iris pattern and facies pattern which were obtained from the image into which comprehensive similarity was inputted as compared with one or more thresholds judge whether it is the thing of the iris pattern and facies pattern which were collated in the collating dictionary sections 5 and 10, and the same person (S17), and the comprehensive judgment section 15 outputs a judgment result.

[0033] In the collating processing in the discernment mode of drawing 3 mentioned above, two kinds of gestalten as follows are adopted. As opposed to the iris pattern and facies pattern with which one of them was obtained from the image of an identified person Each, when the pattern is known that is, it is collating of 1 to 1. it should collate of the iris pattern registered into the collating dictionary sections 5 and 10, and the facies patterns -- one [another] When the pattern which should collate of the iris pattern registered into the collating dictionary sections 5 and 10 and the facies patterns is not known but it chooses the probable iris pattern and a facies pattern out of two or more spa turns registered that is, it is collating of one pair n.

[0034] In collating of 1 to 1, the collating sections 4 and 9 compute similarity using one iris pattern and a facies pattern, respectively, and output it to it to the similarity bond part 14. In collating of one pair n, the collating sections 4 and 9 perform a collating operation using the iris pattern and facies pattern of each plurality in the collating dictionary sections 5 and 10, and send out the high order [the 1st place or the m-th place of a high order (m is any value)] similarity to the similarity bond part 14.

[0035] In this case, although the similarity of the 1st place received from each collating section 4 and 9 or the m-th place of a high order may not belong to the same person. In that case, when the similarity bond part 14 notifies to the comprehensive judgment section 15 noting that it is not probable enough. It can judge with the iris pattern and facies pattern which were obtained from the image of an identified person not belonging to the iris pattern and facies pattern which were used for collating, and the same person.

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[0036] Since according to the gestalt of the 1st operation facies recognition is performed in addition to iris recognition and it is carrying out by [which were explained above] using the similarity of both recognition of discernment of individual specification, it has been strong enough in the position with an identified person impossible for, and without [without it adds a severe limit to surrounding lighting conditions, and] using a camera with many pixels, positive discernment is possible and the high rate of discernment can be obtained.

[0037] Drawing 4 is the block diagram showing the 2nd configuration of the gestalt of operation. The gestalt of this 2nd operation is what connected the comprehensive judgment section 15 to each collating sections 4 and 9 of the iris recognition section 12 and the facies recognition section 13, and connected the similarity bond part 14 to this comprehensive judgment section 15, and is the same as the gestalt of the 1st operation about other configurations. Although the gestalt of this 2nd operation also operates in two kinds of modes, register mode and discernment mode, since register mode is the same as that of the gestalt of the 1st operation, only discernment mode is explained as an operation here.

[0038] Drawing 5 is the flow chart which shows the discernment mode of the gestalt of the 2nd operation, and is explained according to the step shown by S. Since processing to S1-S15 is performed like the gestalt of the 1st operation in this discernment mode, that explanation is omitted, but the pattern which should collate of the iris pattern registered into the registration dictionary sections 5 and 10 and the facies patterns does not understand collating by S9 and S15, but when choosing the probable pattern out of two or more patterns, respectively that is, collating of one pair n is applied.

[0039] Moreover, the difference in actuation of the gestalt of this 2nd operation and the gestalt of the 1st operation is the difference of the diagnosis by the comprehensive judgment section 15 and the similarity bond part 14. That is, the comprehensive judgment section 15 will compute each difference of the similarity to the n-th place of an iris pattern first, if the similarity from each collating section 4 and 9 of the iris recognition section 12 and the facies recognition section 13 to the n-th place of the high order of an iris pattern and a facies pattern is received (S16).

[0040] Next, it judges by threshold a which defined the difference using the experiment or the statistical method beforehand (S17), when a difference is more than threshold a, a comprehensive judgment is performed only using the similarity of an iris pattern, but when the difference is below threshold a, it progresses to the comprehensive similarity calculation which is the following step. For example, when the similarity from the collating section 4 of the iris recognition section 12 to the 2nd place is inputted into the comprehensive judgment section 15, the difference of the similarity of the 1st place inputted in the comprehensive judgment section 15 and the 2nd place is searched for, and it progresses to a comprehensive judgment noting that the iris pattern in which the similarity of the 1st place is shown is probable enough, when this difference is larger than threshold a set up beforehand.

[0041] Moreover, since it cannot say that what has gone up as the 1st place is sufficiently probable when the difference is smaller than a, it does not judge only by the similarity of ** from the iris recognition section 12, but progresses with the following similarity bond part. When the difference of the n-th place of the high order of an iris pattern is smaller than threshold a, The comprehensive judgment section 15 transmits the similarity of the n-th place of the high order of an iris pattern and a facies pattern to the similarity bond part 14, and this is received. The similarity bond part 14 Both similarity is combined using (1) type explained with the gestalt of the 1st operation, comprehensive similarity is computed, and the calculation result is transmitted to the comprehensive judgment section 15 (S18).

[0042] If comprehensive similarity is received from the similarity bond part 14, the comprehensive judgment section 15 will judge the comprehensive similarity as compared with one or more thresholds (S19), and will output the judgment result. That is, the iris pattern and facies pattern which were obtained from the image of an identified person judge whether it is the thing of the iris pattern and facies pattern which were collated in the collating dictionary sections 5 and 10, and the same person, and output the judgment result.

[0043] Also in the gestalt of the 2nd operation, the high recognition rate which was described above and

which was stabilized like the 1st example can be acquired, and moreover, with the gestalt of this 2nd operation, since an identified person is identified without using the similarity of a facies pattern when judged with an iris pattern being probable enough, improvement in the speed of processing can be attained. Drawing 6 is the block diagram showing the 3rd configuration of the gestalt of operation. [0044] With the gestalt of this operation, it consists of the iris recognition section 12, the pretreatment section 2, and the feature-extraction section 3, and the facies recognition section 13 also consists of the pretreatment section 7 and the feature-extraction section 8, and both the feature-extractions sections 2 and 8 are connected to the description bond part 14. And it has the composition that the collating section 16 was formed between the description bond part 14 and the comprehensive judgment section 15, and the collating dictionary section 17 was formed in this collating section 16 and the description bond part 14.

[0045] In addition, it is the same as the gestalt of the 1st and the 2nd operation that each pretreatment section 2 and 7 of the iris recognition section 12 and the facies recognition section 13 sends out the image photoed with the camera 1 by the camera output distribution section 11. The gestalt of operation of three of this ** also operates in two kinds of modes, register mode and discernment mode, drawing 7 is the flow chart of register mode, and drawing 8 is the flow chart in discernment mode.

[0046] In both this mode, there is the description after the feature extraction of the iris recognition section 12 and the facies recognition section 13, respectively. First, when register mode is explained, it is. Each processing from the image input of an identified person with a camera 1 to coding (S1-S8) of the iris in the iris recognition section 12 and coding (S1, S2, S9-S13) of the facies in the facies recognition section 13 is performed like the gestalt of the 1st and the 2nd operation.

[0047] The iris pattern and facies pattern which were coded in the feature-extraction section 3 of the iris recognition section 12 and the feature-extraction section 8 of the facies recognition section 13 are sent to the description bond part 14, it is combined by this description bond part 5, and the description pattern is made (S14). 1-dimensional vector arrangement is adopted as the approach of association in this case. Required data, such as a registrant name, an ID number, and a date, are added, and the combined description pattern is registered into the collating dictionary section 17 (S15).

[0048] Next, discernment mode is explained. Also in this mode, two or more men's description pattern shall be registered into the collating dictionary section 17, respectively. Moreover, since processing from the image input of this discernment mode odor S1 to coding of S13 is performed like the case of the gestalt of the 1st and the 2nd operation, and the register mode of said drawing 7 and the description association of S14 as well as the case of the register mode of drawing 7 is performed, that explanation is omitted.

[0049] The description pattern of the iris pattern and facies pattern by which the description association was carried out by the description bond part 14 is sent to the collating section 16, and similarity is computed by the description pattern registered into the collating dictionary section 17 in this collating section 16, collating, and an operation being performed (S15). Interval scales, such as the Hamming distance, are used also for the collating operation in this case. The similarity (distance value) computed in the collating section 16 is sent to the comprehensive judgment section 15. In this comprehensive judgment section 15 It compares with one or more thresholds which asked for the similarity obtained by the collating section 16 with the experiment or the statistical method beforehand. The description pattern obtained from the inputted image judges whether it is the thing of the description pattern collated in the collating dictionary section 17, and the same person (S16), and outputs the judgment result.

[0050] Two kinds of gestalten as follows are adopted also for the collating processing in the discernment mode of drawing 8 mentioned above. When the description pattern which should collate of the description patterns registered into the collating dictionary section 17 understands one of them (i.e., when it is collating of 1 to 1, and the description pattern which should be collated does not understand one [another] but the probable description pattern is chosen out of two or more persons' description pattern registered) that is, it is collating of one pair n.

[0051] In collating of 1 to 1, the collating section 16 computes similarity using one description pattern registered into the collating dictionary section 17, and outputs it to it to the comprehensive judgment section 15. In the judgment by the comprehensive judgment section 15, it performs, the judgment, i.e., the identification, of being the thing of the description pattern and the same person which the description pattern obtained from the image into which similarity was inputted as compared with one or more thresholds collated, and the result is outputted.

[0052] In collating of one pair n, the collating section 16 performs a collating operation using two or more description patterns registered into the collating dictionary section 17, and outputs the high order [the 1st place or the m-th place of a high order (m is any value)] similarity to it to the comprehensive judgment section 15. In this case, in the judgment by the comprehensive judgment section 15, by whether it is fully most similar to which description pattern with which the description pattern obtained from the image of an identified person collated the similarity similarity of the 1st place or the m-th place of a high order as compared with one or more thresholds, or similar, it performs, a judgment, i.e., the identification, of being the thing of the description pattern and the same person, and that result is outputted.

[0053] According to the gestalt of the 3rd operation, the high recognition rate which was explained above and which was stabilized like the 1st example can be acquired, and moreover, with the gestalt of this 3rd operation, since the collating section and the collating dictionary section can be managed with one, respectively, there is an advantage by which a configuration is simplified. Drawing 9 is the block diagram showing the 4th configuration of the gestalt of operation. The gestalt of this operation is replaced with the camera 1 in the gestalt of the 1st operation at the camera output distribution section 11, is what connected the camera 18 for irises to the pretreatment section 2 of the iris recognition section 12, and connected the camera 19 for facies to the pretreatment section 7 of the facies recognition section 13, respectively, and constitutes other configurations like the gestalt of the 1st operation using the camera 18 for irises, and the camera 19 for facies.

[0054] Therefore, although the image of an identified person is photoed, respectively and is independently sent to the pretreatment sections 2 and 7 with the camera 18 for irises, and the camera 19 for facies with the gestalt of this operation at the time of register mode and discernment mode, processing after it is performed like the gestalt of the 1st operation. While the same effectiveness as the gestalt of the 1st operation carried out in this way is acquired also with the gestalt of the 4th operation, the camera which was adapted for each recognition can be used by having divided the camera for an image input into two sets, the object for iris recognition, and the object for facies recognition.

[0055] For example, low-pricing and a miniaturization can be attained, without dropping the discernment engine performance of equipment compared with the case where can use the camera of a wide angle with a low resolution for the camera of a narrow angle [high resolution], and facies recognition for iris recognition, therefore one expensive and large-sized camera is used. The block diagram in which drawing 10 shows the 5th configuration of the gestalt of operation, and drawing 11 are the block diagrams showing the 6th configuration of the gestalt of operation.

[0056] The gestalt of this the operation of both is also replaced with the 2nd, and the camera 1 and the camera output distribution section 11 in the gestalt of operation of three. Using the camera 18 for irises, and the camera 19 for facies, it is what connected the camera 18 for irises to the pretreatment section 2 of the iris recognition section 12, and connected the camera 19 for facies to the pretreatment section 7 of the facies recognition section 13, respectively, and other configurations are constituted like the gestalt of the 2nd and operation of three.

[0057] Therefore, although the image of an identified person is photoed, respectively and is independently sent to the pretreatment sections 2 and 7 with the camera 18 for irises, and the camera 19 for facies also with the gestalt of this the operation of both at the time of register mode and discernment mode, processing after it is performed like the gestalt of the 2nd and operation of three. While the 2nd and the same effectiveness as the gestalt of operation of three are acquired, respectively also with the gestalt of the 5th and the 6th operation which were carried out in this way Low-pricing and a miniaturization can be attained without dropping the discernment engine performance of equipment, since the camera which was adapted for each recognition by having divided the camera for an image input into two sets, the object for iris recognition and the object for facies recognition, like the gestalt of the 4th operation can be used.

[0058]

[Effect of the Invention] The iris pattern and facies pattern which carried out the feature extraction and which this invention photoed the identified person as explained above, and were obtained from the image Collate with the iris pattern and facies pattern which are registered beforehand, ask for each similarity, and the similarity of this iris pattern and the similarity of a facies pattern are combined. He is trying for the iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result to judge whether it is the thing of the iris pattern and facies pattern which were

used for collating, and the same person.

[0059] Therefore, since according to this facies recognition is performed in addition to iris recognition and it is carrying out by using the similarity of both recognition of discernment of individual specification, it has been strong enough in the position with an identified person impossible for, and without [without it adds a severe limit to surrounding lighting conditions, and] using a camera with many pixels, positive discernment is attained and the effectiveness that the high rate of discernment can be obtained is acquired.

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the identification equipment which identifies an individual using human being's ecological description, especially the iris of an eyeball.

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PRIOR ART

[Description of the Prior Art] When Consumer Transaction Facility performs dealings actuation in a financial institution, or when accessing the data which have secreting nature by computer etc., identification for checking the existence of the rating in the case of entrance to the facility which only further specific human being puts in etc. is performed.

[0003] The thing of current versatility can be considered as a technique of this identification, or although it carries out, there is a technique of identifying an individual using that iris that is some human being's eyeballs as one. Since there is the description of it being completed at infancy, and this iris hardly changing through a lifetime, and being [which grows fat] hard to be influenced of change by the physique of becoming thin, application in the direction of many will be expected highly [discernment precision] therefore in the future.

[0004] Drawing 12 is the functional block diagram showing the conventional common identification equipment using an iris. The pretreatment section which performs from the camera (video camera) with which 1 performs an image input in drawing, and the image by which 2 was photoed with this camera 1, the processing, i.e., pretreatment, which cuts down an iris, 3 is the feature-extraction section which extracts the description of the iris cut down by this pretreatment section 2, and codes that pattern. 4 is the collating section which collates the iris pattern which has registered into the collating dictionary section 5 the iris pattern sent from this feature-extraction section 3, and asks for the similarity between both, and two or more iris patterns for manpower are beforehand stored in the collating dictionary section 5 here.

[0005] 6 is the judgment section both the iris pattern judges whether it is the same person's thing from the similarity computed by the collating section 4 to be. In this configuration, as for the pretreatment section 2, the feature-extraction section 3, the collating section 4, and the judgment section 6, being constituted by a microprocessor and exclusive operation hardware is common, and it is [the collating dictionary section 5] common to consist of semiconductor memory, a magnetic disk, etc.

[0006] Next, an operation of a configuration of having mentioned above is explained. Drawing 13 is a flow chart which shows the procedure at the time of the register mode of an iris pattern, and drawing 14 is a flow chart which shows the procedure in the discernment mode of an iris pattern. First, the register mode of drawing 13 is explained according to the step shown by S.

[0007] The image of the upper half of the body of those, who should register, is photoed with a camera 1. That is, an image input is carried out (S1). Next, the photoed image is sent to the pretreatment section 2, logging (indexing of the location of a head) of a head is performed from the image of an identified person in this pretreatment section 2 (S2), and processing which cuts down an iris from logging (indexing of the location of an eye) (S3) of an eye and the image of this eye (indexing of the location of an iris) is further performed in the sequential pretreatment section 2 from the image of this head (S4).

[0008] The image of this cut-down iris is sent to the feature-extraction section 3, and the description required for collating is extracted in the feature-extraction section 3 (S5). An iris is divided into a required analysis band, or, specifically, the feature extraction of the Gabor filter etc. extracting concentration change of an iris is performed. And it normalizes the description of the extracted iris in the feature-extraction section 3 (S6), it is coded as binary data (S7), and about 256 bytes of iris code is eventually generated as an iris pattern.

[0009] Thus, required data, such as a registrant name, an ID number, and a date, are added, and the generated iris pattern is registered into the collating dictionary section 5 (S8). Next, the discernment

mode of drawing 14 is explained according to the step similarly shown by S. In addition, in this mode, two or more men's iris pattern shall be registered into the above by the collating dictionary section 5 like.

[0010] First, the image input (S1) of an identified person, logging (S2) of a head, logging of an eye (S3), And after being carried out in order in the pretreatment section 2 like the case where it is each processing of an iris of logging (S4) at said registration time, It is carried out in the feature-extraction section 3 like the case where it is each processing of the feature extraction (S5) of an iris, normalization (S6), and coding (S7) at said registration time, and an iris pattern is generated.

[0011] The generated iris pattern is sent to the collating section 4, and in the collating section 4, the collating (matching) operation of the iris pattern sent from this feature-extraction section 3 and the iris pattern registered into the collating dictionary section 5 is carried out, and it asks for similarity (S8). By the collating operation in this case, distance values, such as the Hamming distance, are well used as a scale of similarity.

[0012] The similarity (distance value) of the iris pattern chosen by collating in this collating section 4 is transmitted to the judgment section 6. In the judgment section 6, the iris pattern obtained from the image of an identified person by the experiment or the statistical method as compared with one or more thresholds calculated beforehand judges that it is the thing of the iris pattern with which the sent similarity was collated in the collating dictionary section 5, and the same person (S9).

[0013] In addition, although it can be freely chosen [certain] now which code (who) registered into the collating dictionary 5 as an object for collating is used or whether it is, and it crawls and the pattern (how many persons) of shoes is used and it is determined by the specification of a system in the collating processing in this discernment mode, it divides roughly and two kinds of gestalten as follows are adopted. As opposed to the iris pattern with which one of them was obtained from the image of an identified person When the pattern which should collate of the iris patterns registered into the collating dictionary section 5 is known that is, it is collating of 1 to 1. One [another] When the pattern which should collate of the iris patterns registered into the collating dictionary section 5 is not known but it chooses the probable iris pattern out of two or more persons' iris pattern registered that is, it is collating of one pair n.

[0014] In collating of 1 to 1, the collating section 4 computes similarity using one iris pattern, and outputs the calculation result to it to the judgment section 6. In the judgment in this case, it identifies whether the iris pattern with which the iris pattern obtained from the image of an identified person collated similarity as compared with one or more thresholds belongs to the same person.

[0015] In collating of one pair n, the collating section 4 collates two or more iris patterns in the collating dictionary section 5, performs a collating operation, and sends out the high order [the 1st place or the m-th place of a high order (m is any value)] similarity at the judgment section 6. In this case, the judgment section 6 judges the similarity of the 1st place or the m-th place of a high order with one or more thresholds, investigates whether the iris pattern obtained from the image of an identified person is most similar to which collated iris pattern, or it is not fully similar, and identifies whether the iris pattern collated with the iris pattern obtained from the image of an identified person belongs to the same person.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, this invention should photo an identified person and he needs to do a feature extraction from the image. The iris pattern and the facies pattern which were obtained are collated with the iris pattern and the facies pattern which are registered beforehand, it asks for each similarity, and he combines the similarity of this iris pattern, and the similarity of a facies pattern, and is trying for the iris pattern and the facies pattern which were obtained from the image of an identified person based on that joint result to judge whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[0059] Therefore, since according to this facies recognition is performed in addition to iris recognition and it is carrying out by using the similarity of both recognition of discernment of individual specification, it has been strong enough in the position with an identified person impossible for, and without [without it adds a severe limit to surrounding lighting conditions, and] using a camera with many pixels, positive discernment is attained and the effectiveness that the high rate of discernment can be obtained is acquired.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, with the identification equipment of the iris utilization mentioned above, in recognition equipment, when an identified person did not wink at the time of photography or the data of an exact iris were not obtained by the instability of the image acquisition by the lighting conditions of the instability of the image by the thing, like the hair of hair starts an eye, or a perimeter etc., positive discernment became difficult and there was a problem that where of the rate of discernment fell.

[0017] When solving such a problem, it has been strong enough in the position with an identified person impossible for in order to obtain stabilization of an image, and the increment in a throughput, enlargement of equipment, the formation of an expensive rank, the increment in power consumption, etc. will no longer be avoided, and it will become not realistic to add a severe limit to surrounding lighting conditions, if a camera with many pixels is used in order to gather a recognition rate desirable still more simply on a human interface.

[0018] Therefore, it has been strong enough in the position with an identified person impossible for, and positive discernment is possible for the technical problem of the invention in this application, without [without it adds a severe limit to surrounding lighting conditions, and] using a camera with many pixels, and it is realizing the identification equipment with which the high rate of discernment is obtained.

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MEANS

[Means for Solving the Problem] Therefore, the iris pattern and facies pattern which carried out the feature extraction and which this invention photoed the identified person, and were obtained from the image Collate with the iris pattern and facies pattern which are registered beforehand, ask for each similarity, and the similarity of this iris pattern and the similarity of a facies pattern are combined. The iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result are characterized by judging whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[0020]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of this invention is explained below. Drawing 1 is the block diagram showing the configuration of the 1st of the gestalt of operation of the identification equipment by this invention. This identification unit is constituted by the camera 1 which photos a person, the camera output distribution section 11, the iris recognition section 12, the facies recognition section 13, the similarity bond part 14, and the comprehensive judgment section 15.

[0021] Here, the camera output distribution section 11 undergoes the output from a camera 1, and sends out the output to the iris recognition section 12 and the facies recognition section 13, respectively. The iris recognition section 12 consists of the pretreatment section 2, the feature-extraction section 3, the collating section 4, and the collating dictionary section 5, and the facies recognition section 13 is also constituted by the pretreatment section 7, the feature-extraction section 8, the collating section 9, and the collating dictionary section 10.

[0022] Each part of 2-4 in the iris recognition section 12 is the same as that of the component shown in drawing 13, and each part of 7-10 of the facies recognition section 13 is equivalent to the thing of 2-4. It is what the similarity bond part 14 receives each similarity from the collating section 4 of the iris recognition section 12, and the collating section 10 of the facies recognition section 13, computes comprehensive similarity, and is sent out to the comprehensive judgment section 6 on the other hand.

An identified person judges whether you are the person registered into the collating dictionary section 10 of the collating dictionary section 5 of the iris recognition section 12, and the facies recognition section 13 from the comprehensive similarity sent from the similarity bond part 14, and the comprehensive judgment section 15 outputs the judgment result.

[0023] Next, an operation of the equipment by such configuration is explained. This equipment operates in the two modes, register mode and discernment mode, drawing 2 is the flow chart of register mode, and drawing 3 is the flow chart in discernment mode. First, the register mode of drawing 2 is explained according to the step shown by S.

[0024] The image of the upper half of the body of those (registrant), who should register, is photoed with a camera 1. That is, an image input is carried out (S1). The output of this camera 1 is sent to the camera output distribution section 1, and the image photoed by this camera output distribution section 1 with the camera 1 is distributed to each pretreatment section 2 and 7 of the iris recognition section 12 and the facies recognition section 13 (S2).

[0025] In the iris recognition section 12, each processing of logging (S3) of a head, logging (S4) of an eye, logging (S5) of an iris, the feature extraction (S6) of an iris, normalization (S7), and coding (S8) is performed by the pretreatment section 2 and the feature-extraction section 3 as usual, and an iris pattern is registered into the collating dictionary section 5 (S9). detection (S11) of the field which the

pretreatment section 7 detects the profile of a face in the facies recognition section 13 on the other hand from a registrant's image sent from the camera output distribution section 11 (S10), and shows the description peculiar to faces, such as an eye, a nose, and opening, from the profile -- these relative relation is detected further (S12).

[0026] In the feature-extraction section 8, the description of the inputted face image is normalized and (S13) coded in response to the output of the pretreatment section 7, and a facies pattern is generated (S14). Thus, required data, such as a registrant name, an ID number, and a date, are added, and the generated facies pattern is registered into the collating dictionary section 10 (S15). In addition, although it is necessary to make both this pattern of each other link since an iris pattern and a facies pattern are registered into the collating dictionaries 5 and 10 as mentioned above, respectively, a registrant name and an ID number can be used as data for a link.

[0027] Moreover, processing of the 12 iris recognition section S3 - S9 mentioned above and processing of S10-S15 in the facies recognition section 13 are performed in parallel. Next, the discernment mode of drawing 3 is explained according to the step similarly shown by S. In addition, in this mode, two or more a manpower man's iris patterns and facies patterns shall be registered into the above by the collating dictionary sections 5 and 10 like, respectively.

[0028] First, each processing from the image input of an identified person with a camera 1 to coding (S1-S8) of the iris in the iris recognition section 12 and coding (S1, S2, S10-S14) of the facies in the facies recognition section 13 is performed like the time of said registration. And in the iris recognition section 12, the iris pattern generated in the feature-extraction section 3 is sent to the collating section 4, in the collating section 4, carries out the collating (matching) operation of the iris pattern sent from this feature-extraction section 3, and the iris pattern registered into the collating dictionary section 5, and outputs (S9) and its result to the similarity bond part 14 in quest of similarity.

[0029] In addition, calculation of the similarity in this case is also performed as usual. On the other hand, in the facies recognition section 13, the facies pattern generated in the feature-extraction section 8 is sent to the collating section 9, and in the collating section 9, it collates [the facies pattern registered into the collating dictionary section 10, and], the facies pattern sent from the feature-extraction section 8 is calculated, and it asks for similarity (S15).

[0030] An interval scale etc. is used for this collating operation, and the collating section 9 outputs the similarity (distance value) of the result of an operation to it to the similarity bond part 14. Thus, although each collating of an iris pattern and a facies pattern is performed in each collating section 4 and 9 of the iris recognition section 12 and the facies recognition section 13, the iris pattern and facies pattern of the collating dictionary section 5 which are used for this collating are controlled so that the same person's pattern is surely used.

[0031] Next, the similarity bond part 14 computes comprehensive similarity by combining two similarity received from each collating section 4 and 9 of the iris recognition section 12 and the facies recognition section 13 by the following (1) types (S16).

$T = k * RI + (1 - k) * Rf$ (1) type -- here -- T: synthesis similarity and RI : The similarity by the iris, and Rf : It is the similarity by facies, and k: constant ($1 > k$), and this constant k determines a suitable value with an experiment or a statistical method.

[0032] The comprehensive similarity computed by this similarity bond part 14 is sent out to the comprehensive judgment section 15, the iris pattern and facies pattern which were obtained from the image into which comprehensive similarity was inputted as compared with one or more thresholds judge whether it is the thing of the iris pattern and facies pattern which were collated in the collating dictionary sections 5 and 10, and the same person (S17), and the comprehensive judgment section 15 outputs a judgment result.

[0033] In the collating processing in the discernment mode of drawing 3 mentioned above, two kinds of gestalten as follows are adopted. As opposed to the iris pattern and facies pattern with which one of them was obtained from the image of an identified person Each, when the pattern is known that is, it is collating of 1 to 1. it should collate of the iris pattern registered into the collating dictionary sections 5 and 10, and the facies patterns -- one [another] When the pattern which should collate of the iris pattern registered into the collating dictionary sections 5 and 10 and the facies patterns is not known but it chooses the probable iris pattern and a facies pattern out of two or more spa turns registered that is, it is collating of one pair n.

[0034] In collating of 1 to 1, the collating sections 4 and 9 compute similarity using one iris pattern and

a facies pattern, respectively, and output it to it to the similarity bond part 14. In collating of one pair n, the collating sections 4 and 9 perform a collating operation using the iris pattern and facies pattern of each plurality in the collating dictionary sections 5 and 10, and send out the high order [the 1st place or the m-th place of a high order (m is any value)] similarity to the similarity bond part 14.

[0035] In this case, although the similarity of the 1st place received from each collating section 4 and 9 or the m-th place of a high order may not belong to the same person In that case, when the similarity bond part 14 notifies to the comprehensive judgment section 15 noting that it is not probable enough It can judge with the iris pattern and facies pattern which were obtained from the image of an identified person not belonging to the iris pattern and facies pattern which were used for collating, and the same person.

[0036] Since according to the gestalt of the 1st operation facies recognition is performed in addition to iris recognition and it is carrying out by [which were explained above] using the similarity of both recognition of discernment of individual specification, it has been strong enough in the position with an identified person impossible for, and without [without it adds a severe limit to surrounding lighting conditions, and] using a camera with many pixels, positive discernment is possible and the high rate of discernment can be obtained.

[0037] Drawing 4 is the block diagram showing the 2nd configuration of the gestalt of operation. The gestalt of this 2nd operation is what connected the comprehensive judgment section 15 to each collating sections 4 and 9 of the iris recognition section 12 and the facies recognition section 13, and connected the similarity bond part 14 to this comprehensive judgment section 15, and is the same as the gestalt of the 1st operation about other configurations. Although the gestalt of this 2nd operation also operates in two kinds of modes, register mode and discernment mode, since register mode is the same as that of the gestalt of the 1st operation, only discernment mode is explained as an operation here.

[0038] Drawing 5 is the flow chart which shows the discernment mode of the gestalt of the 2nd operation, and is explained according to the step shown by S. Since processing to S1-S15 is performed like the gestalt of the 1st operation in this discernment mode, that explanation is omitted, but the pattern which should collate of the iris pattern registered into the registration dictionary sections 5 and 10 and the facies patterns does not understand collating by S9 and S15, but when choosing the probable pattern out of two or more patterns, respectively that is, collating of one pair n is applied.

[0039] Moreover, the difference in actuation of the gestalt of this 2nd operation and the gestalt of the 1st operation is the difference of the diagnosis by the comprehensive judgment section 15 and the similarity bond part 14. That is, the comprehensive judgment section 15 will compute each difference of the similarity to the n-th place of an iris pattern first, if the similarity from each collating section 4 and 9 of the iris recognition section 12 and the facies recognition section 13 to the n-th place of the high order of an iris pattern and a facies pattern is received (S16).

[0040] Next, it judges by threshold a which defined the difference using the experiment or the statistical method beforehand (S17), when a difference is more than threshold a, a comprehensive judgment is performed only using the similarity of an iris pattern, but when the difference is below threshold a, it progresses to the comprehensive similarity calculation which is the following step. For example, when the similarity from the collating section 4 of the iris recognition section 12 to the 2nd place is inputted into the comprehensive judgment section 15, the difference of the similarity of the 1st place inputted in the comprehensive judgment section 15 and the 2nd place is searched for, and it progresses to a comprehensive judgment noting that the iris pattern in which the similarity of the 1st place is shown is probable enough, when this difference is larger than threshold a set up beforehand.

[0041] Moreover, since it cannot say that what has gone up as the 1st place is sufficiently probable when the difference is smaller than a, it does not judge only by the similarity of ** from the iris recognition section 12, but progresses with the following similarity bond part. When the difference of the n-th place of the high order of an iris pattern is smaller than threshold a, The comprehensive judgment section 15 transmits the similarity of the n-th place of the high order of an iris pattern and a facies pattern to the similarity bond part 14, and this is received. The similarity bond part 14 Both similarity is combined using (1) type explained with the gestalt of the 1st operation, comprehensive similarity is computed, and the calculation result is transmitted to the comprehensive judgment section 15 (S18).

[0042] If comprehensive similarity is received from the similarity bond part 14, the comprehensive judgment section 15 will judge the comprehensive similarity as compared with one or more thresholds (S19), and will output the judgment result. That is, the iris pattern and facies pattern which were

obtained from the image of an identified person judge whether it is the thing of the iris pattern and facies pattern which were collated in the collating dictionary sections 5 and 10, and the same person, and output the judgment result.

[0043] Also in the gestalt of the 2nd operation, the high recognition rate which was described above and which was stabilized like the 1st example can be acquired, and moreover, with the gestalt of this 2nd operation, since an identified person is identified without using the similarity of a facies pattern when judged with an iris pattern being probable enough, improvement in the speed of processing can be attained. Drawing 6 is the block diagram showing the 3rd configuration of the gestalt of operation.

[0044] With the gestalt of this operation, it consists of the iris recognition section 12, the pretreatment section 2, and the feature-extraction section 3, and the facies recognition section 13 also consists of the pretreatment section 7 and the feature-extraction section 8, and both the feature-extractions sections 2 and 8 are connected to the description bond part 14. And it has the composition that the collating section 16 was formed between the description bond part 14 and the comprehensive judgment section 15, and the collating dictionary section 17 was formed in this collating section 16 and the description bond part 14.

[0045] In addition, it is the same as the gestalt of the 1st and the 2nd operation that each pretreatment section 2 and 7 of the iris recognition section 12 and the facies recognition section 13 sends out the image photoed with the camera 1 by the camera output distribution section 11. The gestalt of operation of three of this ** also operates in two kinds of modes, register mode and discernment mode, drawing 7 is the flow chart of register mode, and drawing 8 is the flow chart in discernment mode.

[0046] In both this mode, there is the description after the feature extraction of the iris recognition section 12 and the facies recognition section 13, respectively. First, when register mode is explained, it is. Each processing from the image input of an identified person with a camera 1 to coding (S1-S8) of the iris in the iris recognition section 12 and coding (S1, S2, S9-S13) of the facies in the facies recognition section 13 is performed like the gestalt of the 1st and the 2nd operation.

[0047] The iris pattern and facies pattern which were coded in the feature-extraction section 3 of the iris recognition section 12 and the feature-extraction section 8 of the facies recognition section 13 are sent to the description bond part 14, it is combined by this description bond part 5, and the description pattern is made (S14). 1-dimensional vector arrangement is adopted as the approach of association in this case. Required data, such as a registrant name, an ID number, and a date, are added, and the combined description pattern is registered into the collating dictionary section 17 (S15).

[0048] Next, discernment mode is explained. Also in this mode, two or more men's description pattern shall be registered into the collating dictionary section 17, respectively. Moreover, since processing from the image input of this discernment mode odor S1 to coding of S13 is performed like the case of the gestalt of the 1st and the 2nd operation, and the register mode of said drawing 7 and the description association of S14 as well as the case of the register mode of drawing 7 is performed, that explanation is omitted.

[0049] The description pattern of the iris pattern and facies pattern by which the description association was carried out by the description bond part 14 is sent to the collating section 16, and similarity is computed by the description pattern registered into the collating dictionary section 17 in this collating section 16, collating, and an operation being performed (S15). Interval scales, such as the Hamming distance, are used also for the collating operation in this case. The similarity (distance value) computed in the collating section 16 is sent to the comprehensive judgment section 15. In this comprehensive judgment section 15 It compares with one or more thresholds which asked for the similarity obtained by the collating section 16 with the experiment or the statistical method beforehand. The description pattern obtained from the inputted image judges whether it is the thing of the description pattern collated in the collating dictionary section 17, and the same person (S16), and outputs the judgment result.

[0050] Two kinds of gestalten as follows are adopted also for the collating processing in the discernment mode of drawing 8 mentioned above. When the description pattern which should collate of the description patterns registered into the collating dictionary section 17 understands one of them (i.e., when it is collating of 1 to 1, and the description pattern which should be collated does not understand one [another] but the probable description pattern is chosen out of two or more persons' description pattern registered) that is, it is collating of one pair n.

[0051] In collating of 1 to 1, the collating section 16 computes similarity using one description pattern registered into the collating dictionary section 17, and outputs it to it to the comprehensive judgment

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section 15. In the judgment by the comprehensive judgment section 15, it performs, the judgment, i.e., the identification, of being the thing of the description pattern and the same person which the description pattern obtained from the image into which similarity was inputted as compared with one or more thresholds collated, and the result is outputted.

[0052] In collating of one pair n, the collating section 16 performs a collating operation using two or more description patterns registered into the collating dictionary section 17, and outputs the high order [the 1st place or the m-th place of a high order (m is any value)] similarity to it to the comprehensive judgment section 15. In this case, in the judgment by the comprehensive judgment section 15, by whether it is fully most similar to which description pattern with which the description pattern obtained from the image of an identified person collated the similarity similarity of the 1st place or the m-th place of a high order as compared with one or more thresholds, or similar, it performs, a judgment, i.e., the identification, of being the thing of the description pattern and the same person, and that result is outputted.

[0053] According to the gestalt of the 3rd operation, the high recognition rate which was explained above and which was stabilized like the 1st example can be acquired, and moreover, with the gestalt of this 3rd operation, since the collating section and the collating dictionary section can be managed with one, respectively, there is an advantage by which a configuration is simplified. Drawing 9 is the block diagram showing the 4th configuration of the gestalt of operation. The gestalt of this operation is replaced with the camera 1 in the gestalt of the 1st operation at the camera output distribution section 11, is what connected the camera 18 for irises to the pretreatment section 2 of the iris recognition section 12, and connected the camera 19 for facies to the pretreatment section 7 of the facies recognition section 13, respectively, and constitutes other configurations like the gestalt of the 1st operation using the camera 18 for irises, and the camera 19 for facies.

[0054] Therefore, although the image of an identified person is photoed, respectively and is independently sent to the pretreatment sections 2 and 7 with the camera 18 for irises, and the camera 19 for facies with the gestalt of this operation at the time of register mode and discernment mode, processing after it is performed like the gestalt of the 1st operation. While the same effectiveness as the gestalt of the 1st operation carried out in this way is acquired also with the gestalt of the 4th operation, the camera which was adapted for each recognition can be used by having divided the camera for an image input into two sets, the object for iris recognition, and the object for facies recognition.

[0055] For example, low-pricing and a miniaturization can be attained, without dropping the discernment engine performance of equipment compared with the case where can use the camera of a wide angle with a low resolution for the camera of a narrow angle [high resolution], and facies recognition for iris recognition, therefore one expensive and large-sized camera is used. The block diagram in which drawing 10 shows the 5th configuration of the gestalt of operation, and drawing 11 are the block diagrams showing the 6th configuration of the gestalt of operation.

[0056] The gestalt of this the operation of both is also replaced with the 2nd, and the camera 1 and the camera output distribution section 11 in the gestalt of operation of three. Using the camera 18 for irises, and the camera 19 for facies, it is what connected the camera 18 for irises to the pretreatment section 2 of the iris recognition section 12, and connected the camera 19 for facies to the pretreatment section 7 of the facies recognition section 13, respectively, and other configurations are constituted like the gestalt of the 2nd and operation of three.

[0057] Therefore, although the image of an identified person is photoed, respectively and is independently sent to the pretreatment sections 2 and 7 with the camera 18 for irises, and the camera 19 for facies also with the gestalt of this the operation of both at the time of register mode and discernment mode, processing after it is performed like the gestalt of the 2nd and operation of three. While the 2nd and the same effectiveness as the gestalt of operation of three are acquired, respectively also with the gestalt of the 5th and the 6th operation which were carried out in this way Low-pricing and a miniaturization can be attained without dropping the discernment engine performance of equipment, since the camera which was adapted for each recognition by having divided the camera for an image input into two sets, the object for iris recognition and the object for facies recognition, like the gestalt of the 4th operation can be used.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the gestalt of operation of the 1st of the identification equipment by this invention.

[Drawing 2] It is the flow chart which shows an operation of the gestalt of the 1st operation.

[Drawing 3] It is the flow chart which shows an operation of the gestalt of the 1st operation.

[Drawing 4] It is the block diagram showing the gestalt of operation of the 2nd of the identification equipment by this invention.

[Drawing 5] It is the flow chart which shows an operation of the gestalt of the 2nd operation.

[Drawing 6] It is the block diagram showing the gestalt of operation of the 3rd of the identification equipment by this invention.

[Drawing 7] It is the flow chart which shows an operation of the gestalt of the 3rd operation.

[Drawing 8] It is the flow chart which shows an operation of the gestalt of the 3rd operation.

[Drawing 9] It is the block diagram showing the gestalt of operation of the 4th of the identification equipment by this invention.

[Drawing 10] It is the block diagram showing the gestalt of operation of the 5th of the identification equipment by this invention.

[Drawing 11] It is the block diagram showing the gestalt of operation of the 6th of the identification equipment by this invention.

[Drawing 12] It is the block diagram showing the conventional technique.

[Drawing 13] It is the flow chart which shows an operation of the conventional technique.

[Drawing 14] It is the flow chart which shows an operation of the conventional technique.

[Description of Notations]

1 Camera

2 Pretreatment Section

3 Feature-Extraction Section

4 Collating Section

5 Collating Dictionary Section

7 Pretreatment Section

8 Feature-Extraction Section

9 Collating Section

10 Collating Dictionary Section

11 Camera Output Distribution Section

12 Iris Recognition Section

13 Facies Recognition Section

14 Similarity Bond Part

15 Comprehensive Judgment Section

16 Collating Section

17 Collating Dictionary Section

18 Camera for Irises

19 Camera for Facies

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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
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G06F 15/62 465 K

[Procedure amendment]
[Filing Date] January 22, Heisei 15 (2003. 1.22)
[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] Claim 2
[Method of Amendment] Modification
[Proposed Amendment]
[Claim 2] In identification equipment according to claim 1,

The camera which photos a person,

The pretreatment section which cuts down an iris from the image which this camera photoed, the feature-extraction section which extract the description of the iris cut down by this pretreatment section, and obtain an iris pattern, the collating dictionary section which register the iris pattern obtained by this feature-extraction section at the time of registration, and the iris recognition section which have the collating section which collates the iris pattern obtained by the feature-extraction section at the time of discernment with the iris pattern registered into said collating dictionary section, asks for similarity, It is this feature-extraction section at the time of the pretreatment section which detects the field which shows the profile and the description of a face from the image which said camera photoed, its relative relation, etc., the feature-extraction section which extracts the description of the facies detected in this pretreatment section, and obtains a facies pattern, and registration. The collating dictionary section which registers the obtained facies pattern, and the facies recognition section which has the collating section which collates the facies pattern obtained by the feature-extraction section at the time of discernment with the facies registered into said collating dictionary section, and asks for similarity, The similarity bond part which combines the similarity of the iris pattern sent from each collating section of said iris recognition section and the facies recognition section, and the similarity of a facies

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pattern,

Identification equipment characterized by equipping the iris pattern and facies pattern which were obtained from the image of an identified person based on the joint result sent from this similarity bond part with the comprehensive judgment section which judges whether it is the thing of the iris pattern and facies pattern which were used for collating, and the same person.

[Procedure amendment 2]

[Document to be Amended] Description

[Item(s) to be Amended] Claim 4

[Method of Amendment] Modification

[Proposed Amendment]

[Claim 4] In identification equipment according to claim 3,

The camera which photos a person,

The pretreatment section which cuts down an iris from the image which this camera photoed, the feature-extraction section which extract the description of the iris cut down by this pretreatment section, and obtain an iris pattern, the collating dictionary section which register the iris pattern obtained by this feature-extraction section at the time of registration, and the iris recognition section which have the collating section which collates the iris pattern obtained by the feature-extraction section at the time of discernment with the iris pattern registered into said collating dictionary section, asks for similarity, It is this feature-extraction section at the time of the pretreatment section which detects the field which shows the profile and the description of a face from the image which said camera photoed, its relative relation, etc., the feature-extraction section which extracts the description of the facies detected in this pretreatment section, and obtains a facies pattern, and registration. The collating dictionary section which registers the obtained facies pattern, and the facies recognition section which has the collating section which collates the facies pattern obtained by the feature-extraction section at the time of discernment with the facies pattern registered into said collating dictionary section, and asks for similarity,

The similarity bond part which combines the similarity of the iris pattern sent through the comprehensive judgment section from each collating section of said iris recognition section and the facies recognition section, and the similarity of a facies pattern,

The iris pattern obtained from the image of an identified person by the similarity of the iris pattern sent from the collating section of said iris recognition section judges whether it is the thing of the iris pattern same person who used for collating,

The identification equipment with which the iris pattern and the facies pattern which made combine the similarity of said iris pattern and the similarity of the facies pattern sent from the collating section of said facies recognition section by said similarity bond part, and obtained from the image of an identified person based on the joint result when not belonging to the same person are characterized by to have the comprehensive judgment section which judges whether it is the thing of the iris pattern and the facies pattern used for collating, and the same person.

[Procedure amendment 3]

[Document to be Amended] Description

[Item(s) to be Amended] Claim 5

[Method of Amendment] Modification

[Proposed Amendment]

[Claim 5] In identification equipment according to claim 1 or 3,

Similarity of an iris pattern, and similarity of a facies pattern,

$$T=k*RI+(1-k)*Rf$$

T: Comprehensive similarity

RI : similarity by the iris

Rf : similarity by facies

k: Constant ($1>k$)

Identification equipment characterized by joining together by the formula to say.

[Procedure amendment 4]

[Document to be Amended] Description

[Item(s) to be Amended] Claim 7

[Method of Amendment] Modification

25.

[Proposed Amendment]

[Claim 7] In identification equipment according to claim 6,

The camera which photos a person,

The pretreatment section which cuts down an iris from the image which this camera photoed, and the iris recognition section which has the feature-extraction section which extracts the description of the iris cut down by this pretreatment section, and obtains an iris pattern,

The pretreatment section which detects the field which shows the profile and the description of a face from the image which said camera photoed, its relative relation, etc., and the facies recognition section which has the feature-extraction section which extracts the description of the facies detected in this pretreatment section, and obtains a facies pattern,

The description bond part which combines the iris pattern and facies pattern which are sent from each feature-extraction section of said iris recognition section and the facies recognition section, and makes the description pattern,

The collating dictionary section which registers the description pattern made from this description bond part at the time of registration,

the description pattern registered into said collating dictionary section in the description pattern sent from said description bond part at the time of discernment -- joining together -- ** -- the collating section which collates and asks for similarity,

Identification equipment characterized by equipping the description pattern obtained from the image of an identified person based on the similarity sent from this collating section with the comprehensive judgment section which judges whether it is the thing of the description pattern used for collating, and the same person.

[Procedure amendment 5]

[Document to be Amended] Description

[Item(s) to be Amended] Claim 9

[Method of Amendment] Modification

[Proposed Amendment]

[Claim 9] In claim 2, claim 4, or identification equipment according to claim 7,

Identification equipment which makes one set the camera which photos a person and is characterized by having the camera output distribution section which distributes the output of this camera to both the iris recognition section and the facies recognition section.

[Procedure amendment 6]

[Document to be Amended] Description

[Item(s) to be Amended] Claim 10

[Method of Amendment] Modification

[Proposed Amendment]

[Claim 10] In claim 2, claim 4, or identification equipment according to claim 7,

It is a preparation about the camera for irises, and the camera for facies.

It is delivery to the iris recognition section about the image photoed with the camera for irises,

Identification equipment characterized by sending the image photoed with the camera for facies to the facies recognition section.

[Procedure amendment 7]

[Document to be Amended] Description

[Item(s) to be Amended] 0040

[Method of Amendment] Modification

[Proposed Amendment]

[0040] Next, it judges by threshold a which defined the difference using the experiment or the statistical method beforehand (S17), when a difference is more than threshold a, a comprehensive judgment is performed only using the similarity of an iris pattern, but when the difference is under threshold a, it progresses to the comprehensive similarity calculation which is the following step. For example, when the similarity from the collating section 4 of the iris recognition section 12 to the 2nd place is inputted into the comprehensive judgment section 15, in the comprehensive judgment section 15, the difference of the similarity of the 1st inputted place and the 2nd place is searched for, and it progresses to a comprehensive judgment noting that it is the same as threshold a which this difference set up beforehand, or the iris pattern in which the similarity of the 1st place is shown is probable enough, when

26.

large.

[Procedure amendment 8]

[Document to be Amended] Description

[Item(s) to be Amended] 0041

[Method of Amendment] Modification

[Proposed Amendment]

[0041] Moreover, since it cannot say that what has gone up as the 1st place is sufficiently probable when the difference is smaller than a, it does not judge only by the similarity from the iris recognition section 12, but progresses to the next comprehensive similarity calculation. When the difference of the n-th place of the high order of an iris pattern is smaller than threshold a, the comprehensive judgment section 15 should receive the similarity bond part 14. an iris -- a pattern -- and -- facies -- a pattern -- a high order -- n -- place -- similarity -- transmitting -- this -- winning popularity -- similarity -- a bond part -- 14 -- the -- one -- operation -- a gestalt -- having explained -- (-- one --) -- a formula -- using -- both similarity -- joining together -- comprehensive similarity -- computing -- the calculation result -- the comprehensive judgment section 15 -- transmitting (S18) .

[Procedure amendment 9]

[Document to be Amended] Description

[Item(s) to be Amended] 0045

[Method of Amendment] Modification

[Proposed Amendment]

[0045] In addition, it is the same as the gestalt of the 1st and the 2nd operation to send out the image photoed with the camera 1 by the camera output distribution section 11 to each pretreatment section 2 and 7 of the iris recognition section 12 and the facies recognition section 13. The gestalt of this 3rd operation also operates in two kinds of modes, register mode and discernment mode, drawing 7 is the flow chart of register mode, and drawing 8 is the flow chart in discernment mode.

[Translation done.]